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ORGANIZATIONAL MAINTENANCE MANUAL

MODULATOR-OSCILLATOR GROUP OA-2180/FRT-51

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HEADQUARTERS, DEPARTMENT OF THE ARMY
23 NOVEMBER 1966

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on

the dc circuits, or on the

115/230-ac line connections.

DON'T TAKE CHANCES!

TECHNICAL MANUAL
No. 11-5820-215-12

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20315, *23 November 1966*

MODULATOR-OSCILLATOR GROUP OA-2180/FRT-51

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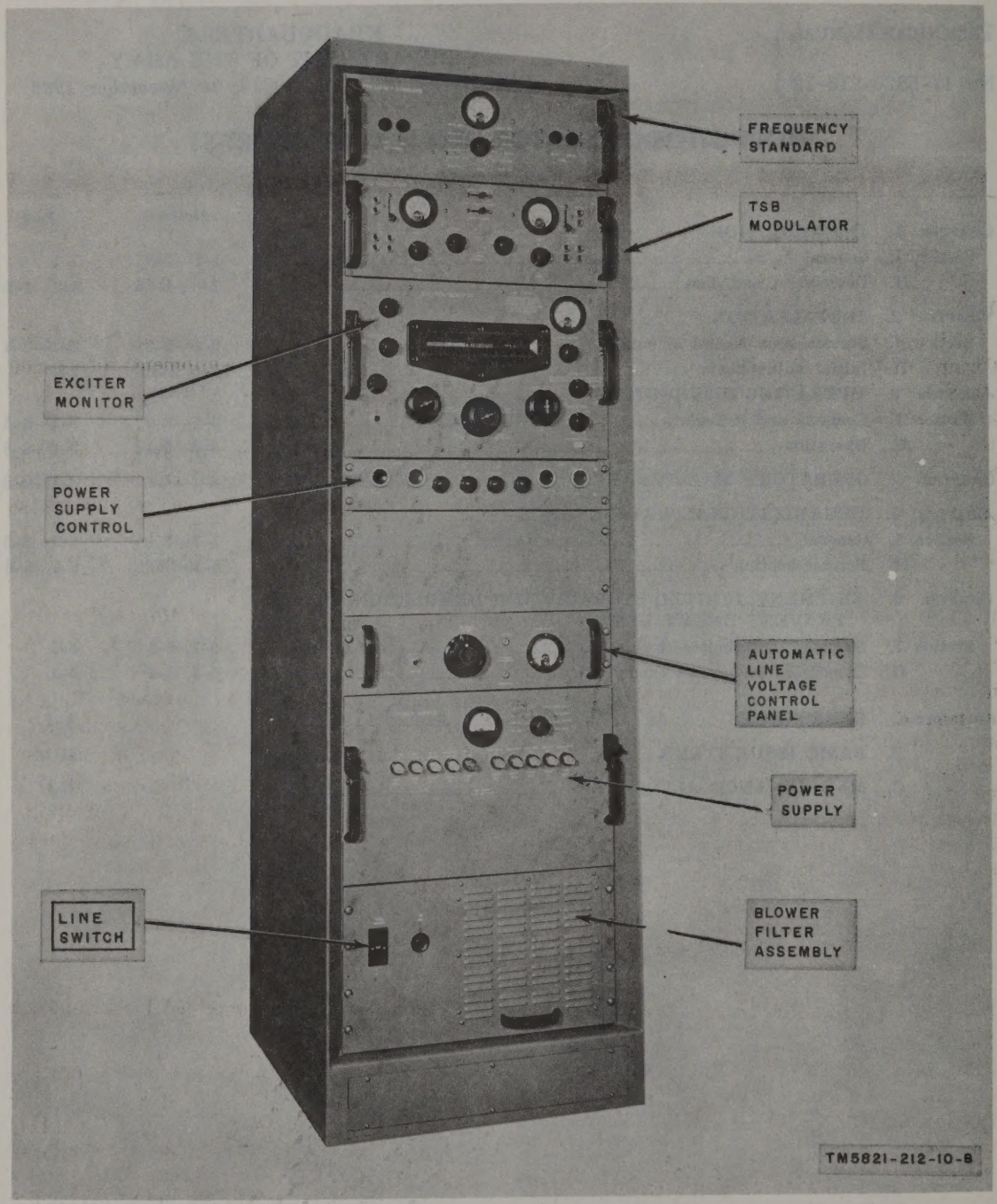


Figure 1-1. Modulator-Oscillator Group OA-2180/FRT-51.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1–1. Scope

This manual describes Modulator-Oscillator Group OA–2180/FRT–51 (fig. 1–1) and provides instruction for installation, operation, and operator and organizational maintenance. It includes instructions for cleaning and inspection of the equipment, and replacement of parts available to the operator and organizational repairman.

1–2. Index of Publications

Refer to the latest issue of DA Pam 310–4 to determine whether there are new editions, changes, or additional publications pertaining to this equipment. DA Pam 310–4 is an index of current technical manuals, technical bulletins, supply manuals (types 7, 8, and 9), supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (–10, –20, –35P, etc) and the latest changes to and revisions of each equipment publication.

1–3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38–750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71–4 (Air Force).

c. Reporting of Equipment Manual Improvements. Report of errors, omissions, and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL–MR–NMP–AD, Fort Monmouth, New Jersey 07703.

Section II. DESCRIPTION AND DATA

1–4. Purpose and Use

a. Modulator-Oscillator Group OA–2180/FRT–51 is an extremely stable radiofrequency (rf) exciter and modulator with a continuously variable output frequency within the range of 1.7 to 32.3 megacycles (mc).

b. The OA–2180/FRT–51 has input circuits for two input lines carrying voice or audiofrequency telegraph signals (or multiple channels of either or both with suitable multiplexing equipment) and will drive a linear radiofrequency amplifier to produce twin-sideband (tsb) or single-sideband (ssb) transmission.

c. Figure 1–2 is a simplified block diagram of the OA–2180/FRT–51.

(1) Voice frequency (vf) speech or telegraph signals are applied to Converter-Amplifier-Modulator CV–1411/FRT–51. These signals are combined with a 100-kilocycle (kc) carrier signal (generated by Frequency Oscillator-Divider O–1044/FRT–51) and produce upper and lower sidebands. These signals are heterodyned with a 400–kc signal derived from the supplied 100–kc signal by means of a

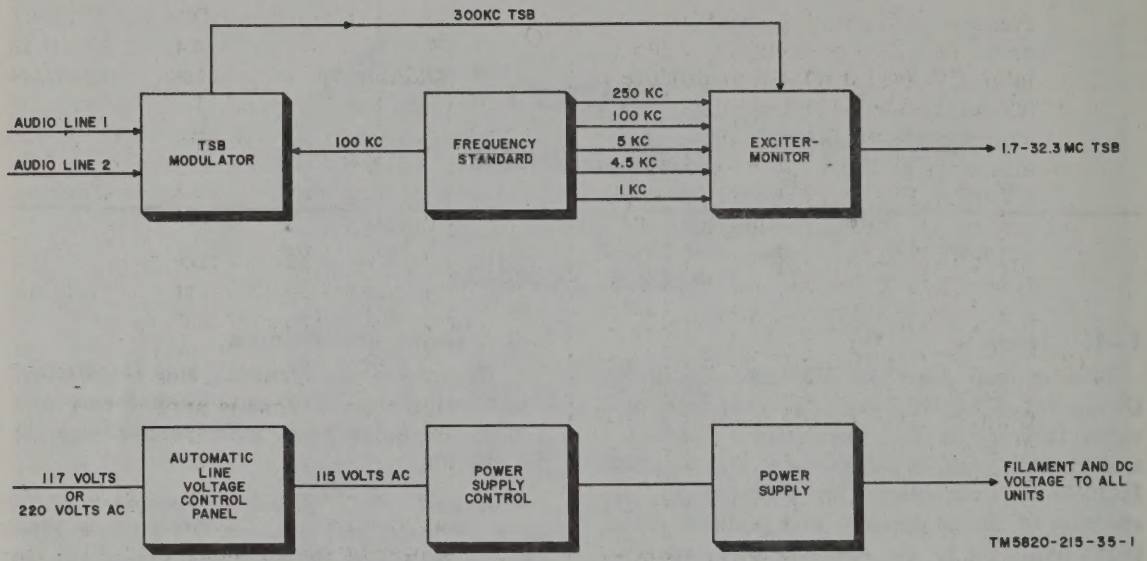


Figure 1-2. Modulator-Oscillator Group OA-2108/FRT-51, simplified block diagram.

frequency multiplier, which is a part of Converter-Amplifier-Modulator CV-1411/FRT-51 to produce a 300-kc twin-sideband signal. Provision is made for filtering either of the sidebands so that the output of the CV-1411/FRT-51 available for application to Converter-Monitor CV-1410/FRT-51 may be either a 300-kc twin-sideband signal or a 300-kc single-sideband (ssb) signal.

(2) The O-1044/FRT-51 develops frequencies of 1, 4.5, 5, 100, and 250-kc from a 1-mc crystal oscillator and divider circuit. A portion of the 100-kc output is applied to the CV-1411/FRT-51, where it is mixed with the audio input signal. All the output frequencies of the O-1044/FRT-51 are applied to the CV-1410/FRT-51.

(3) The 300-kc twin- or single-sideband signal from the CV-1411/FRT-51 is applied to the CV-1410/FRT-51 in addition to the output frequencies from the O-1044/FRT-51. Mixer and multiplier circuits are used in the CV-1410/FRT-51 to produce a 1.7-32.3-mc twin- or single-sideband signal.

(4) The input line voltage (117 or 220 volts alternating current (ac)) is applied to Transformer Assembly TF-425/FRT-51. The output of the TF-425/FRT-51 is a closely regulated 115 volts ac that is applied to Power Supply PP-3564/FRT-51 through Control-Indicator C-4445/FRT-51. The C-4445/FRT-51 controls the application of filament and plate power by the PP-3564/FRT-51. The PP-3564/FRT-51 provides the correct operating potentials to all the units in the OA-2180/FRT-51.

1-5. Technical Characteristics

Type of emission	Twin-sideband or single-sideband suppressed carrier with carrier level adjustable from 0 to 40 db below peak envelope power. Low-level amplitude modulation.
Frequency range	1.7 to 32.3 mc continuous, in. 5-kc steps for maximum stability.
Power output	Automatically adjustable up to .1-watt maximum peak envelope power.
Frequency presentation	Direct reading on counter-type dial.
Tuning method	Automatic or manual; remote or local selection of 10 preset channels.
Frenquency change time	20 seconds maximum.
Frequency stability	1 part in 10^8 per day with 0.5-kc spectrum detent; $\pm$ 100 cycles for continuous tuning following 24-hour warmup.
Output impedance	52 ohms unbalanced.
Input	Two 600-ohm unbalanced inputs.
Frequency response	$\pm$1 db from 100 cps to 6,000 cps for each sideband.
Intermodulation distortion	40 db below 1 tone of a standard two-tone test signal.
Spurious output	All mixer spurious outputs 60 db below peak envelope power; all harmonics of output frequency 50 db below peak envelope power.

Automatic load control ——— Allows one sideband channel to utilize full peak envelope power in the absence of input to the other channel; overloading is prevented when both channels are active. Automatic load control compression may be metered on the front panel.

Monitoring ——— Built-in aural monitor of audio output is provided. Panel meters and selectors switches allow fault location and performance check of subassemblies during operation.

Cooling ——— Filtered forced air, positive pressure.

Input power ——— 115 volts (115/230 volts ±15% when line voltage control is used), 50 to 60 cycles, single-phase, 1,000 watts, power factor higher than 0.9.

Equipment compatibility ——— The modulator-oscillator contains internal circuits and connectors that are compatible for operation with a radio-frequency amplifier such as the AM–1154A/G.

1–6. Components and Common Names of Modulator-Oscillator Group OA-2180/FRT-51 (fig. 1–1)

a. Components. The components of the modulator-oscillator are listed in the following table:

Quantity	Item	Dimension (in.)			Unit weight (lb)
		Height	Depth	Width	
1	Cabinet, Electrical Equipment CY–3747/FRT–51.	72	24	22	313
1	Oscillator-Divider, Frequency O–1044/FRT–51.	8	22.25	19	37
1	Converter-Amplifier-Modulator CV–1411/FRT–51.	7	22.5	19	42
1	Converter-Monitor CV–1410/FRT–51.	12.25	22.25	19	102
1	Control-Indicator C–4445/FRT–51.	3.5	4.5	19	4.5
1	Cooler, Air, Electronic Equipment HD–581/FRT–51.	10.5	21.5	11	24
1	Interconnecting Box J–2123/FRT–51.	9	20.5	6.25	10.5
1	Power Supply PP–3564/FRT–51.	12.25	22.25	19	129
1	Transformer Assembly TF–425/FRT–51.	5.25	23.5	19	73
1	Maintenance Kit, Electronic Equipment MK–686/FRT–51.	7.5	8	17	20.5

b. Running Spares. Running spares for the OA–2180/FRT–51 is listed in appendix B.

c. Common Names. A list of nomenclature assignments for the major components of modulator-oscillator is given in the chart below. A common name is indicated for each item.

Nomenclature	Common name
Modulator-Oscillator Group OA–2180/FRT–51.	Modulator-Oscillator.
Cabinet, Electrical Equipment CY–3747/FRT–51.	Cabinet.
Frequency Oscillator-Divider O–1044/FRT–51.	Frequency standard.
Converter-Amplifier-Modulator CV–1411/FRT–51.	Tsb modulator.
Converter-Monitor CV–1410/FRT–51.	Exciter-monitor.
Control-Indicator C–4445/FRT–51.	Power supply control.
Cooler, Air, Electronic Equipment HD–581/FRT–51.	Blower filter assembly.
Interconnecting Box J–2123/FRT–51.	Main junction box.
Transformer Assembly TF–425/FRT–51.	Automatic line voltage control panel.
Power Supply PP–3564/FRT–51.	Power supply.

1–7. Description of Modulator-Oscillator (fig. 1–1)

The modulator-oscillator consists of panel-chassis assemblies mounted in a cabinet. Each unit may be pulled out of the cabinet for servicing. Screw fasteners on the front panel of each unit secure the units to the cabinet. A switch on the blower filter assembly controls application of power to the power supply and frequency standard. The power supply control switches filament and plate power to the remaining units. The automatic line voltage control panel provides continuous adjustment of the line voltage to 115 volts under normal operating conditions. All power and control circuit interconnections between units of this group are made through the main junction box located in the blower filter assembly.

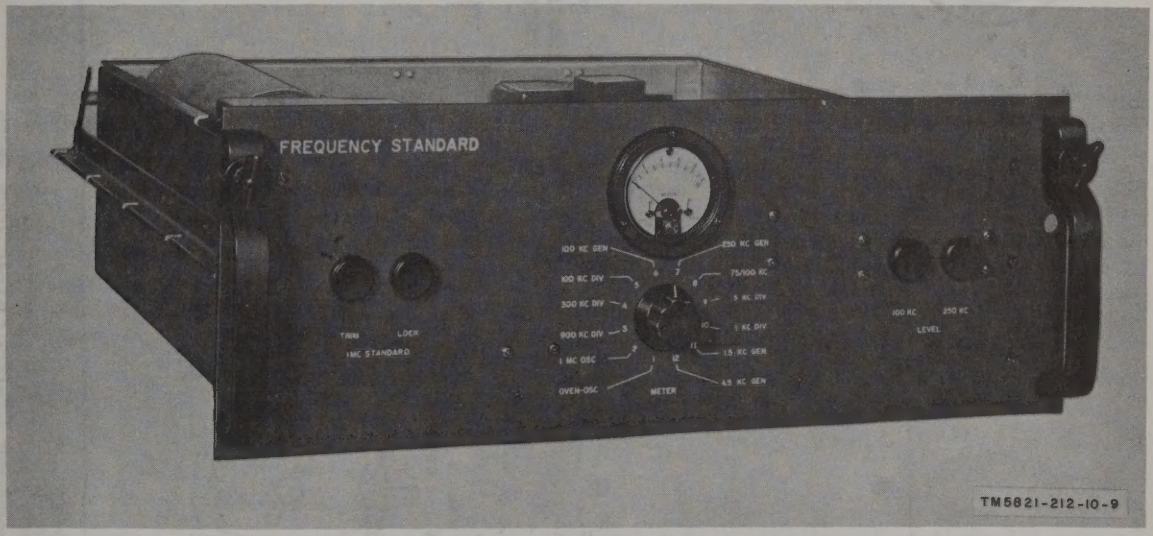


Figure 1–3. Frequency Oscillator-Divider O–1044/FRT–51, front panel.

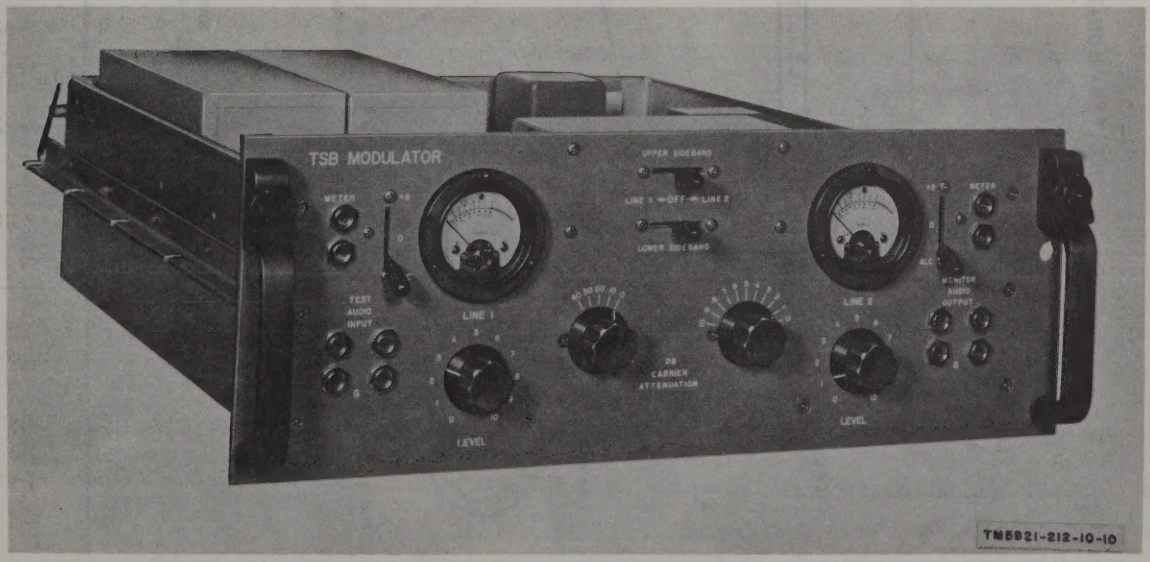


Figure 1–4. Converter-Amplifier-Modulator CV–1441/FRT–11, front panel.

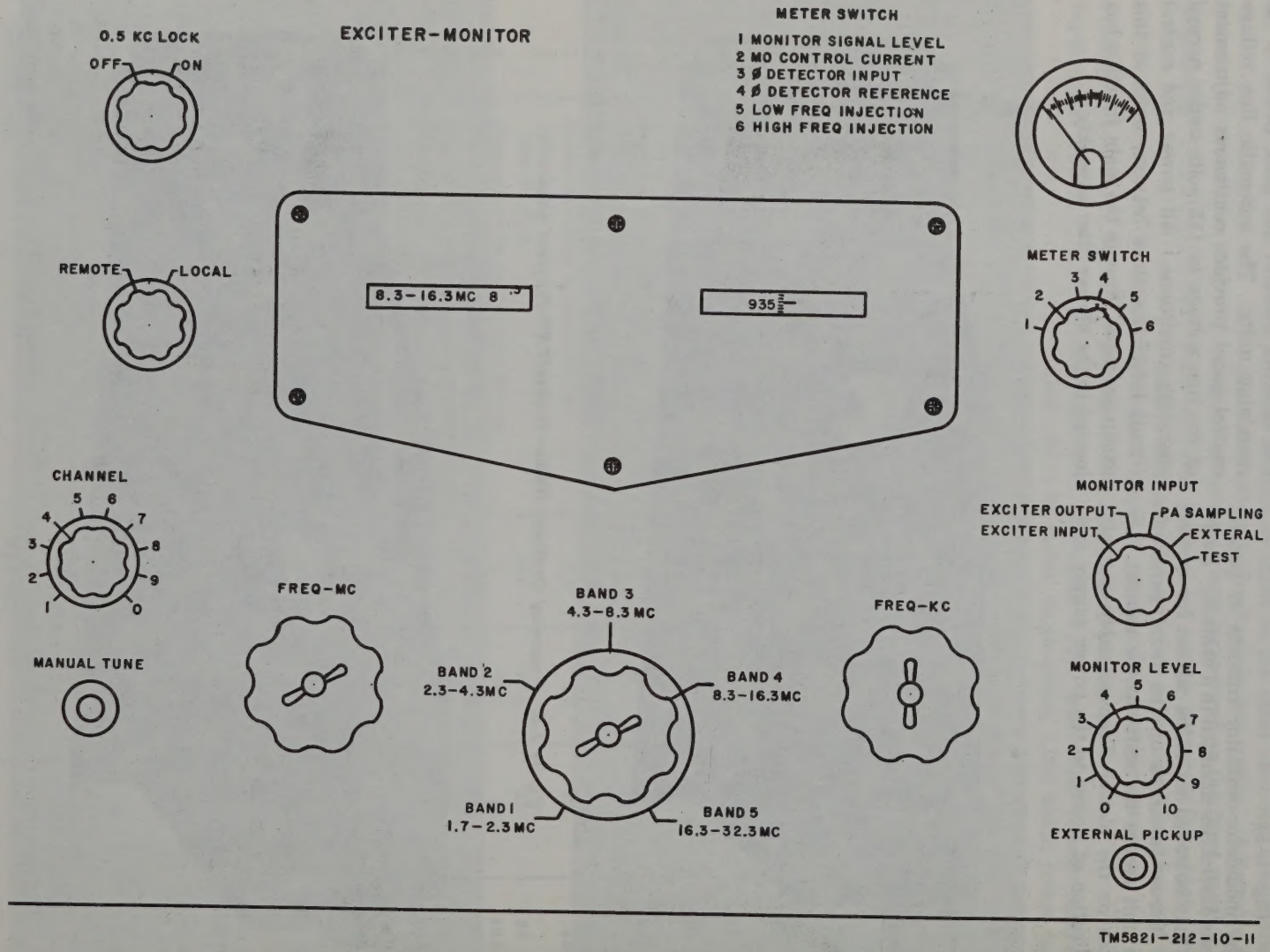


Figure 1-5. Converter-monitor CV-1410/FRT-51, front panel.

1–8. Description of Frequency Standard (fig. 1–3)

The frequency standard consists of six removable subassemblies that are secured to the frequency standard chassis by captive screws. The front panel contains a centrally located test meter, meter switch, and four openings for access to screwdriver-adjustable potentiometers and a trimmer capacitor. The four front-panel access openings are covered with removable screwcaps.

1–9. Description of Tsb Modulator (fig. 1–4)

The tsb modulator contains six removable subassemblies that are secured to the tsb modulator chassis by captive screws. The front panel of the tsb modulator contains the required operating controls and indicators. Two volume unit (vu) meters are provided to measure the level of the audio signal on both input lines.

Figure 1–6. Control-Indicator C–4445/FRT–51, front panel.

Figure 1–7. Transformer Assembly TF–425/FRT–51, front panel.

1—10. Description of Exciter-Monitor
(fig. 1–5)

The exciter-monitor contains 16 removable subassemblies. The front-panel assembly contains a test meter and the required operating controls for the exciter-monitor. The signal paths between the subassemblies and other units are completed by miniature coaxial cables. Power and control circuit connections are completed to the main junction box (fig. 5–6) (located within the blower filter assembly (fig. 1–1)) by an external cable. The interpolation oscillator and master oscillator are housed in tank-type oven assemblies.

1—11. Description of Power Supply Control
(fig. 1–6)

The power supply control contains momentary pushbutton-type switches that control the application of filament and plate power to all units, except the power supply (fig. 1–8) and frequency standard (fig. 1–3). Three indicator lamps glow when the line, filament, and plate voltages are applied; a fourth lamp indicates when the stabilized master oscillator (smo), which is a part of the exciter-monitor, is phased locked.

1—12. Description of Automatic Line Voltage Control Panel
(fig. 1–7)

The automatic line voltage control panel provides for manual or automatic line voltage control. The front panel contains the necessary controls and adjustments and a meter to indicate the adjusted line voltage.

1—13. Description of Power Supply
(fig. 1–8)

The power supply furnishes power to all the units in the modulator-oscillator. Connections between the power supply and the other components are made through the main junction box (fig. 5–6) in the blower filter assembly and interconnecting cabling. The power supply front panel contains 10 fuseholders with blown fuse indicators. A switch, together with a test meter, permits monitoring the voltages at the various units in the modulator-oscillator.

1—14. Description of Blower Filter Assembly
(fig. 1–1)

The blower filter assembly contains the main junction box (fig. 5–6) and a switch that controls the application of power to the power supply (fig. 1–8) and the frequency standard (fig. 1–3). A 115–volt ac utility outlet is also located on the front panel.

1—15. Additional Equipment Required

The additional equipment required for the operation of the modulator-oscillator depends on the type of service to be performed. In all types of installations, it is necessary to have a power source of 117 volts or 220 volts ac. A line equalizing amplifier is required when the audio input is applied from a balanced line or for amplification purposes if the incoming audio signal is below 0 vu. The addition of suitable multiplexing equipment is necessary to enable the modulator-oscillator to accommodate multiple channel inputs.

Figure 1–8. Power Supply PP–3564/FRT–51, front panel.

CHAPTER 2

INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

2–1. Siting

The availability of good antenna sites will help determine the siting of the equipment. When the modulator-oscillator is used in conjunction with an rf transmitter, consider the following factors when selecting a site:

a. Radio signals are absorbed and sometimes reflected by nearby obstructions, such as hills, metal buildings and bridges, or telephone lines that extend above the height of the antenna. Transmitted signals have a greater range when the antenna is as high above ground as possible. Transmission and reception are best over water or level ground.

b. If transmission and reception in all directions are required, place the antenna on the highest hill within the designated area.

c. When in rear areas, avoid placing the set near sources of electrical interference, such as power or telephone lines, radar sets, and field hospitals.

d. Try several locations within the general area and select the one that provides the best signals.

e. The selection of a site and design of the installation should be undertaken only by trained personnel.

2–2. Shelter Requirements

The building that houses the modulator-oscillator must meet the following requirements:

a. The floor must be capable of sustaining the weight of the equipment in a level position without vibration. Total weight of the modulator-oscillator is approximately 720 pounds.

Note: If the modulator-oscillator is used as part of Radio Transmitting Set AN/FRT–51, the total weight of the equipment is approximately 4,580 pounds.

b. The floorspace must measure at least 10 by 10 feet to provide room for efficient and convenient use of the modulator-oscillator. This area includes space for the modulator-oscillator and sufficient space to allow for removal of units for servicing and for work by maintenance personnel around the equipment.

c. A ceiling height of at least 9 feet is necessary to allow for installation of radiofrequency transmission lines.

d. Adequate ventilation must be provided. Power is dissipated in the cooling air of the modulator-oscillator with the hot air being exhausted from ducts in the cabinet top. Operation of the modulator-oscillator in a poorly ventilated room will cause the surrounding temperature to become too high. Temperature and humidity control and filtering should be used where dust, humidity, or temperature is extreme.

2–3. Unpacking

a. Packaging Data. The modulator-oscillator may be shipped in oversea packing cases or in domestic packing cases. When a new modulator-oscillator is received, move it to its intended site before uncrating or unpacking. The entire modulator-oscillator, including spare parts, is packed in wooden crates. All units are carefully braced in the crates to prevent damage due to shifting during shipment. The large unit is crated by placing it upright on a wooden base and securing the unit to the base with metal straps passed over the top of the unit and bolted to the wooden base at each end. The base is bolted to the bottom of the packing case and the rest of the case is built around the unit. It is necessary to use a hoist or considerable manpower to move the crate into position.

b. Removing Contents. Unpack the equipment as follows:

(1) Place the packing case near the position where the equipment is to be installed.

(2) Cut and remove the steel straps and reinforce the corners of the case.

(3) Remove the nails with a nailpuller.

(4) Remove the top and sides of the packing case.

Caution: **Prying off the sides or top of the case may result in damage to the equipment.**

(5) Remove the bags of desiccant that are distributed throughout the equipment to absorb moisture.

(6) Remove the cabinet from its base, and move it into position on the floor.

(7) Many of the components within the cabinet have been blocked in place with wooden supports, padding, or tape. Remove all packing material. Untie all components that have been bound in place with tape. The specific blocking and taping done during packing may vary in minor detail from unit to unit. The blower assembly, located in the base of the cabinet, is secured with reversible C-blocks prior to shipment to prevent shipping damage. Before placing the equipment in operation, release the blower assembly mounting bolts, remove the C-blocks, turn them over, and replace. Tighten the bolts. The points of the C-blocks must be pointing upward during operation and serve as protection against blower vibration overtravel.

(8) Carefully remove the smaller units from their packing cases, but do not install them in their places until they have been thoroughly checked.

2–4. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (para 1–3).

b. See that the equipment is complete as listed on the packing slip. If a packing slip is not available, check the equipment against the basic issue items (appx B). Report all discrepancies in accordance with TM 38–750. Shortage of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

c. If the equipment has been used or reconditioned, see whether it has been changed by a modification work order (MWO). If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see whether the MWO number (if any) and appropriate notations concerning the modification has been entered in the equipment manual.

Note: Current MWO's applicable to the equipment are listed in DA Pam 310–4.

2–5. Installation of Modulator-Oscillator

The installation of the modulator-oscillator includes the replacement of items that were removed from the unit for shipment, positioning of the unit, and bolting the unit to the floor or mounting surface.

Caution: **Provide ventilation for the modulator-oscillator for adequate heat dissipation. Avoid installing the modulator-oscillator close to heat-producing equipment such as space heater.**

2–6. Air Intake Provisions

(fig. 2–1 and 2–2)

a. General. The cabinet is designed to permit a choice of air intake arrangements. Three air intake openings are located in the cabinet.

(1) Louvered opening in blower filter assembly front panel.

(2) Opening at the base of the front.

(3) The underside of the cabinet.

b. Access Panel Adapter Plates. Access panel adapter plates are supplied with the cabinet. The chart below describes the plates, their location when shipped, and lists their uses.

Figure 2–1 letter designation	Number supplied	Description	Location when shipped	Notes
A	1	Blank plate	Outside front access opening.	May be used to close front or rear access opening.
B	2	Cable entrance or blank plate.	Outside rear access opening.	Used in pairs. When shipped, they are installed to provide cable entry. Reverse one plate to make a blank cover. May be used on either front or rear access opening.
C	1	Intake grill	Outside front access opening in front of plate A.	Used to provide air intake through the front access opening.
D	2	Air-duct collars	Inside front access opening behind plates A and C, extending backward into cabinet.	Used in pairs to connect air ducts to either the front or rear access opening. The air-duct collars can be installed on either the front or rear access opening with collars facing out. Fasten duct to collars with clamps or by drilling and tapping collars.
E	1	Combination air exhaust screen and duct collar.	Top of cabinet over air exhaust opening, collar extending downward into cabinet.	To connect exhaust duct, reverse screen so that collar faces out. Fasten duct with clamps or by drilling and tapping collar.

c. Air Intake Through Front of Cabinet.

(1) Remove blank plate A and install air-duct collar D as described in the chart (*b* above).

(2) There should be no plate covering the louvers on the inner surface of the front panel. If a plate is there, remove it.

(3) Insert remaining plates as required.

d. Air Intake From Beneath Cabinet. Use this arrangement if the ventilating air is drawn through a suitable grill in the floor directly beneath the cabinet.

(1) Fasten blank plate A in place of intake grill C over the opening at the base.

(2) Fasten a plate over the frame that borders the louvers on the inner surface of the front panel.

(3) Insert the remaining plates as required.

2–7. Installation Procedures

a. Choose a location for the equipment that meets the space and air intake requirements listed in paragraph 2–2.

b. Locate and drill four ¾-inch mounting holes in the floor or mounting surface.

c. Use the ⅝– by 8–inch bolts provided with the equipment to bolt the cabinet securely to the floor or mounting surface.

2–8. Cable Connector Fabrication

(fig. 2–3, 2–4, and 2–5)

When the modulator-oscillator is initially shipped, the coaxial cables are completely assembled. The instructions for cable connector fabrication in figures 2–3, 2–4, and 2–5 are for repairing defective cables or assembling new cables. Figure 2–3 contains instructions for connecting a UG–154/U connector to an RG–17A/U coaxial cable or similar coaxial

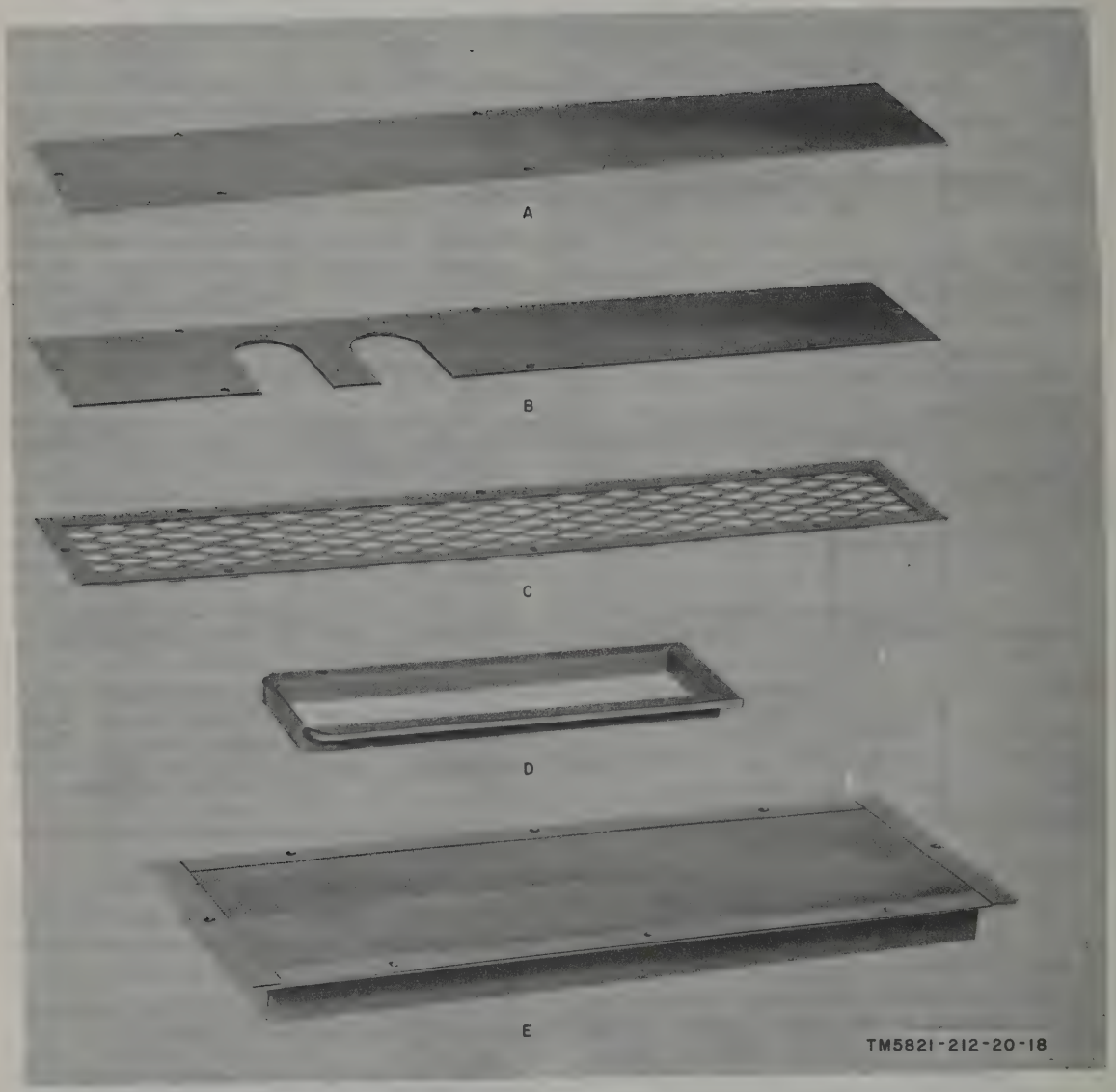


Figure 2–1. Access panel adapter plates.

transmission line. Figures 2–4 and 2–5 provide instructions for connecting two different types of BNC connectors to an RG–58/U or similar coaxial transmission line.

Section II. INITIAL ADJUSTMENTS

2–9. General

Personnel performing these procedures should be familiar with the use of controls and indicators and with the operating procedures in paragraphs 3–9 and 3–10.

2–10. Initial Adjustments

Note: Refer to paragraphs 3–2 through 3–7 for a description of controls and indicators. The procedures in *a* through *d* below are provided only as a basis for determining operational status of the equipment. The services of higher category personnel are required to

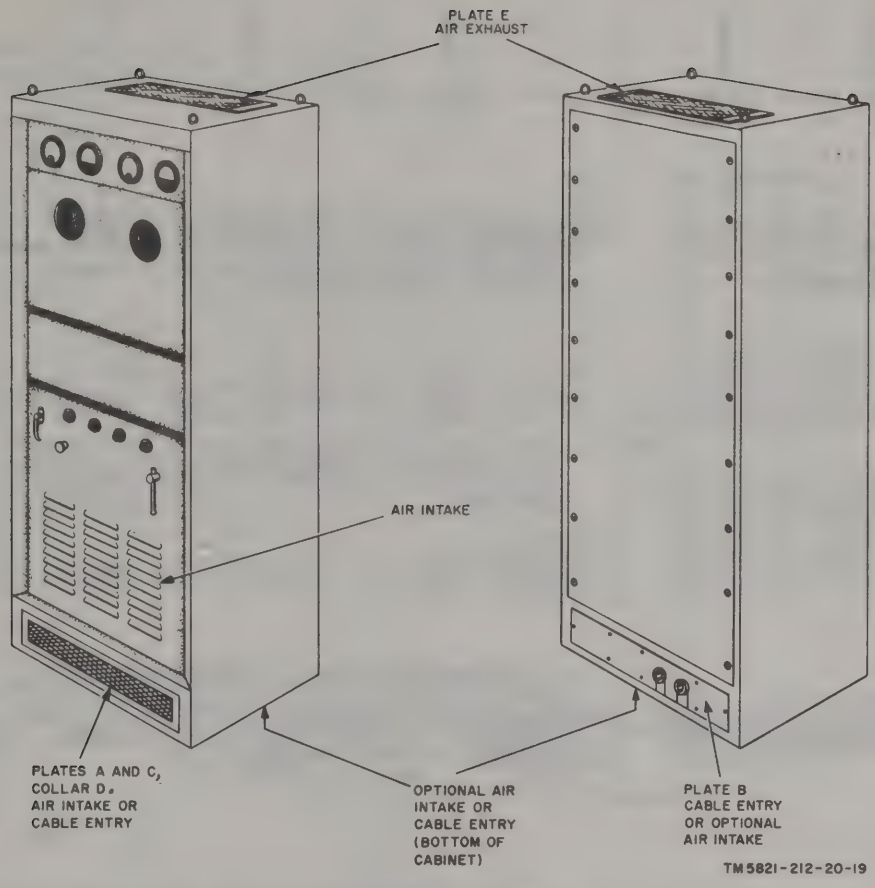


Figure 2–2. Air intake arrangement.

remedy improper indications beyond the scope of front-panel control adjustments.

a. Preliminary Voltage Checks. The preliminary voltage checks insure that all the major units within the modulator-oscillator are supplied with correct operating voltages.

(1) Operate the blower filter assembly LINE SWITCH (fig. 1–1) to ON. Observe that the power supply control LINE indicator glows.
panel AUTOMATIC-MANUAL

(2) Set the automatic line voltage control panel AUTOMATIC-MANUAL switch to AUTOMATIC (fig. 1–7).

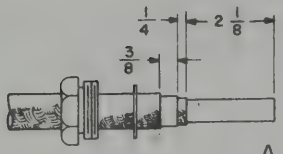
(3) Set the SENSITIVITY control to the clockwise stop.

(4) Set the VOLTAGE control to obtain 115 volts ac as indicated on the LINE VOLTAGE meter.

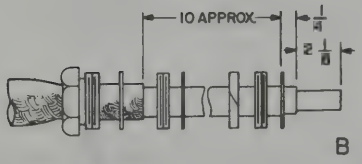
Note: If minor voltage fluctuations result in erratic deflection of the LINE VOLTAGE meter, turn the SENSITIVITY control counterclockwise until the LINE VOLTAGE meter needle remains stationary.

(5) Operate the meter switch on the power supply (fig. 1–8) to +300V FREQ. STD. and +150V FREQ. STD. to check the frequency standard supply voltages. Observe that the test meter pointer rests in the green band (approximately 10) for either position of the meter switch.

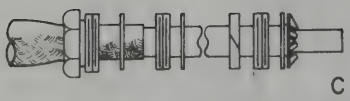
(6) Press the FILAMENT ON button on the power supply control (fig. 1–6). Note that the blower starts and that the green FILAMENT indicator lights.



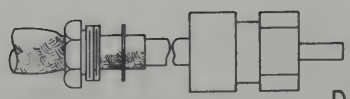
CUT CABLE END FLUSH. SLIDE ARMOR NUT AND WASHER #3 OVER ARMOR. CAREFULLY CUT 2 3/4 INCHES OF ARMOR OFF CABLE FROM CUT END. DO NOT CUT OR NICK JACKET OF CABLE. CUT CABLE JACKET 2 3/8 INCHES FROM END OF CABLE. DO NOT CUT INTO CABLE DIELECTRIC.



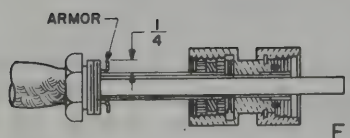
PUSH ARMOR BACK APPROX. 12 3/8" FROM END. SLIDE SPANNER NUT #2, WASHER #2, GASKET AND SPANNER NUT #1 OVER CABLE JACKET. CAREFULLY SLIDE WASHER #1 OVER COPPER BRAID AS SHOWN IN B.



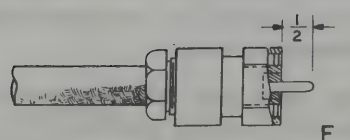
FAN OUT COPPER BRAID RADIALLY, TRIM ANY LOOSE OR RAGGED EDGES WITH CUTTERS OR SCISSORS. ALL METAL PARTICLES MUST BE CLEANED OFF DIELECTRIC. SLIDE CLAMP OVER DIELECTRIC (PRONGS TOWARD CONNECTOR AS SHOWN) AND PRESS IT AGAINST COPPER BRAID. APPLY DOW CORNING #4 COMPOUND, OR EQUIVALENT, TO CLAMP SURFACES.



SCREW SPANNER NUT #1 VERY TIGHT AGAINST WASHER. EXERT SUFFICIENT PRESSURE TO LOCK BRAID AND CABLE BY FLATTENING CLAMP. THIS WILL INSURE GOOD CONTACT WITH BRAID. APPLY A THIN FILM OF DOW CORNING #4 COMPOUND, OR EQUIVALENT, TO SURFACE OF GASKET TO PROVIDE BETTER SEALING. SLIDE WASHER #2 AGAINST GASKET. SCREW SPANNER NUT #2 TIGHT AGAINST WASHER #2.



TURN UP ARMOR 1/4" (RADIALLY). PUSH ARMOR INTO BODY BY SQUEEZING BULGE. PUSH WASHER #3 AGAINST ARMOR. SCREW UP ARMOR NUT TIGHT AGAINST WASHER #3. WITH SHARP KNIFE CUT DIELECTRIC FLUSH WITH FORWARD EDGE OF COUPLING RING. DO NOT NICK CENTER CONDUCTOR. PRY OFF CUT DIELECTRIC. CUT OFF CENTER CONDUCTOR 1/2" FROM FORWARD EDGE OF COUPLING RING. FILE END OF CENTER CONDUCTOR ROUND AND CLEAN OFF ALL FILINGS. IT IS GOOD PRACTICE TO APPLY A SMALL AMOUNT OF DOW CORNING #4 COMPOUND, OR EQUIVALENT, TO END OF DIELECTRIC JUST BEFORE MATING THIS PLUG.



NOTE: WHEN USING UG-154/U WITH UG-215/U, UG-216/U, UG-217/U OR EQUIVALENT, NO FURTHER PREPARATION IS REQUIRED. FOR USE WITH HIGHER VOLTAGE-RATING TYPES, SUCH AS UG-155/U, UG-208/U OR EQUIVALENT, A PORTION OF THE POLYETHYLENE DIELECTRIC MUST BE COUNTERBORED AS SHOWN BY DOTTED LINES IN F. COUNTERBORE A 3/16 I.D. X 7/16 O.D. HOLE TO A DEPTH OF 1/4. THE 1/2 INCH DIMENSION SHOWN IN F SHOULD THEN BE 1/4 INCH. WHEN USING RG-17/U CABLE DISREGARD ALL INSTRUCTIONS PERTAINING TO ARMOR.

TM5821-212-20-23

Figure 2-3. Assembly instructions for UH-154/U connector.

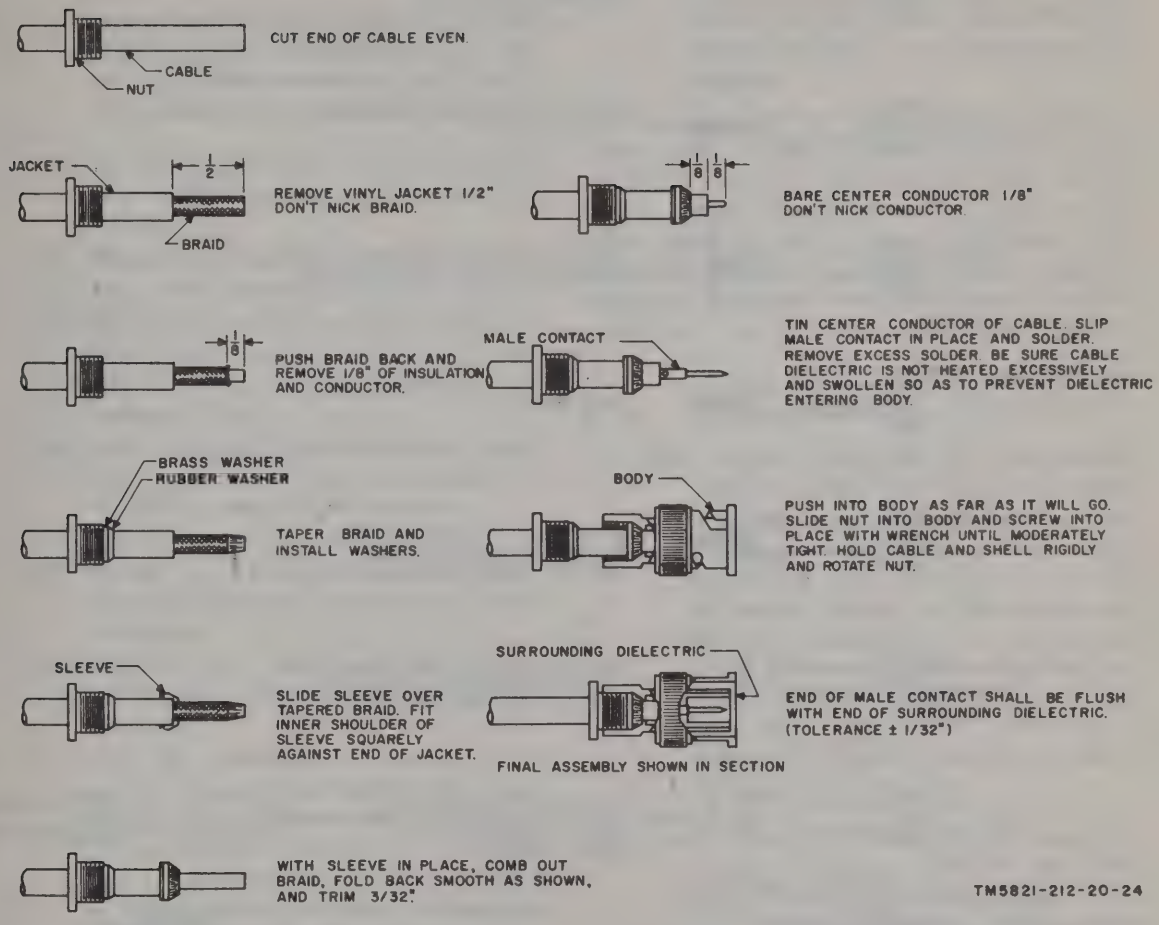

CUT END OF CABLE EVEN.
CABLE
NUT
JACKET
1/2
REMOVE VINYL JACKET 1/2" DON'T NICK BRAID.
BRAID
1/8
1/8
BARE CENTER CONDUCTOR 1/8" DON'T NICK CONDUCTOR.
1/8
PUSH BRAID BACK AND REMOVE 1/8" OF INSULATION AND CONDUCTOR.
MALE CONTACT
TIN CENTER CONDUCTOR OF CABLE. SLIP MALE CONTACT IN PLACE AND SOLDER. REMOVE EXCESS SOLDER. BE SURE CABLE DIELECTRIC IS NOT HEATED EXCESSIVELY AND SWOLLEN SO AS TO PREVENT DIELECTRIC ENTERING BODY.
BRASS WASHER
RUBBER WASHER
TAPER BRAID AND INSTALL WASHERS.
BODY
PUSH INTO BODY AS FAR AS IT WILL GO. SLIDE NUT INTO BODY AND SCREW INTO PLACE WITH WRENCH UNTIL MODERATELY TIGHT. HOLD CABLE AND SHELL RIGIDLY AND ROTATE NUT.
SLEEVE
SLIDE SLEEVE OVER TAPERED BRAID. FIT INNER SHOULDER OF SLEEVE SQUARELY AGAINST END OF JACKET.
SURROUNDING DIELECTRIC
END OF MALE CONTACT SHALL BE FLUSH WITH END OF SURROUNDING DIELECTRIC. (TOLERANCE ± 1/32")
FINAL ASSEMBLY SHOWN IN SECTION
WITH SLEEVE IN PLACE, COMB OUT BRAID, FOLD BACK SMOOTH AS SHOWN, AND TRIM 3/32".
TM5821-212-20-24

Figure 2–4. Assembly instructions for BNC-type male connector.

(7) Operate the power supply meter switch (fig. 1–8) to +28V MOTOR, +28V RELAY, and −150V BIAS. Observe that the test meter indicates in the green band (approximately 10) for each position of the meter switch.

(8) Press the PLATE ON button on the power supply control (fig. 1–6). Note that the red PLATE indicator lights.

(9) Operate the power supply meter switch (fig. 1–8) to +300V EXCITER. Observe that the test meter indicates in the green band (approximately 10).

(10) Operate the meter switch to +125V EXCITER. Note that the test meter pointer indicates a reading of 10.

(11) Operate the meter switch to +210V EXCITER position. Note that the test meter pointer indicates a reading of 10.

b. Setting 100–Kc and 250–Kc Levels.

(1) Set the METER switch on the frequency standard (fig. 1–3) to 6-100 KC GEN. Unscrew the cap that covers the 100 KC LEVEL adjustment control, and use a screwdriver to set the control for a test METER reading of one-half full scale.

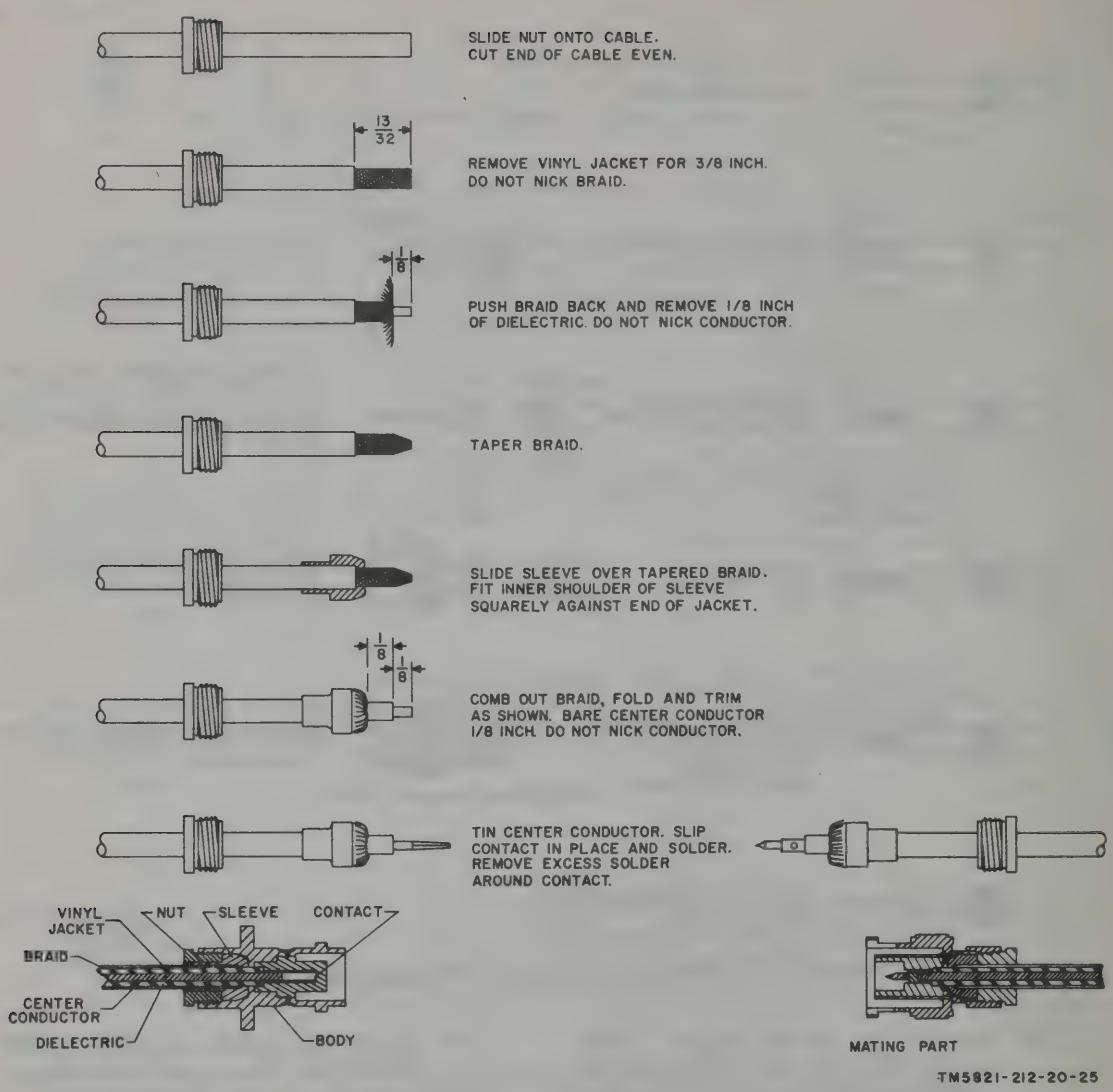


Figure 2–5. Assembly instructions for BNC-type female connector.

(2) Operate the METER switch to 7 - 250 KC GEN. Set the 250 KC LEVEL adjustment control for a test METER reading of one-half full scale.

c. Presetting Autotune System. The chart in (9) below shows settings at the high- and low-frequency ends of each band to provide checkpoints for subsequent frequency and output reading.

(1) Tighten the three autotune locking keys on the exciter-monitor front panel (fig. 1–5). One each locking key is located on the FREQ-KC, the FREQ-MC, and the BAND controls.

Caution: **To prevent loss of channel settings, tighten the locking keys for the FREQ-KC, FREQ-MC, and BAND controls on the exciter-monitor (fig. 1–5) before pressing the FILAMENT ON button ((3) below) of the**

power supply control (fig. 1–6), before switching the REMOTE-LOCAL control, or before switching the CHANNEL selector on the exciter-monitor.

(2) Set the REMOTE-LOCAL switch on the exciter-monitor (fig. 1–5) to LOCAL.

(3) Press the FILAMENT ON button on the power supply control (fig. 1–6).

(4) Set the CHANNEL selector switch on the exciter-monitor (fig. 1–5) to one (first setting in the chart in (9) below).

(5) After the autotune motor stops, loosen the locking keys for the FREQ-MC, FREQ-KC, and BAND controls.

(6) Rotate the BAND control to 1.

(7) Rotate the FREQ-MC and FREQ-KC controls to obtain a reading of 1,700.5 kilocycles.

(8) Tighten the locking keys for the FREQ-MC, FREQ-KC, and BAND controls.

(9) Set the CHANNEL selector to 2. After the autotune mechanism stops, repeat the procedures in (5) through (8) above to set up 2,299.5 kc on channel 2. Repeat this procedure to preset the remaining channels (3 through 10) as listed in the chart below.

CHANNEL switch position	BAND switch position	FREQ-MC switch position	FREQ-KC switch position
1	1	1.7	00.5
2	1	2.2	99.5
3	2	2.3	00.0
4	2	4.3	00.0
5	3	4.3	50.0
6	3	8.2	50.0
7	4	8.3	00.0
8	4	16.2	99.5
9	5	16.3	00.0
10	5	30.0	00.0

(10) Press the power supply control PLATE ON button (fig. 1–6), set the exciter-monitor CHANNEL selector (fig. 1–5) to each position, and see that the autotune tunes the exciter-monitor to the dial settings listed in the chart in (9) above and that the power supply control STABILIZED indicator (fig. 1–6) lights at each dial setting.

d. Adjustment of 1–Mc Crystal Oscillator. After the blower filter assembly LINE SWITCH (fig. 1–1) has been on for at least 24 hours, perform the steps in (1), (2), and (3) below to check the rf output frequency of the modulator-oscillator against WWV or against a primary frequency standard which has an accuracy of one part 10 in a million, or better.

(1) Set the 0.5 KC LOCK switch on the exciter-monitor (fig. 1–5) to ON.

(2) Connect a 50–ohm, 1–watt resistor between EXC RF OUT jack J3809 (fig. 5–6) on the main junction box, (located within the blower filter assembly) and ground. Couple the rf output through a 0.05–microfarad, 600–volt capacitor to a communications receiver. If this coupling provides a greater input to the receiver than that supplied by WWV or a primary frequency standard, use a resistor of lower value.

(3) Tune the receiver to the 10–megacycle output frequency of WWV and compare it with the 10th harmonic of the 1–mc crystal oscillator. Observe the movement of the pointer on the S-meter of the receiver. Remove the LOCK cap on the frequency standard, and loosen the locking screw that prevents the 1–mc trimmer capacitor from turning. Remove the TRIM cap, and adjust the trimmer capacitor for zero beat on the test METER. (S-meter should dip sharply when zero beat is obtained.) The accuracy of the 1–mc crystal oscillator is determined by the accuracy of the frequency standard to which it is compared and the care with which the oscillator is adjusted. The 1–mc crystal oscillator is capable of maintaining an accuracy of 1 part in 100 million per day. Tighten the locking screw after the oscillator trimmer has been adjusted, and replace the cap.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. CONTROLS AND INDICATORS

3–1. General

Paragraphs 3–2 through 3–7 list the operating controls and indicators of Modulator-Oscillator Group OA–2180/FRT–51.

3–2. Frequency Standard (fig. 1–3)

Control or indicator	Function
1MC STANDARD TRIM (screwdriver adjustment[a]).	Provides fine adjustment of output frequency in 1–mc crystal oscillator. *Note:* IMC STANDARD LOCK must be loosened before making this adjustment.
1MC STANDARD LOCK (screwdriver adjustment[a]).	Mechanically locks 1MC STANDARD TRIM trimmer capacitor in position.
100 KC LEVEL (screwdriver adjustment[a])	Controls the gain of 100–kc output.
250 KC LEVEL (screwdriver adjustment[a])	Controls the gain of 250–kc output.
Test METER and METER switch	Meter monitors any one of 12 circuits which may be selected by the METER switch. Switch positions and monitoring functions are as follows:

Position	*Function*
1 OVEN–OSC	Indicates crystal oscillator over voltage.
2 1 MC OSC	Indicates level of agc potential supplied by final buffer stage in crystal oscillator.
3 900 KC DIV	Indicates level of 900–kc signal developed in 1–mc to 100–kc divider.
4 300 KC DIV	Indicates level of 300–kc output of 1–mc to 100–kc divider.
5 100 KC DIV	Indicates level of 100–kc output of 1–mc to 100–kc divider.
6 100 KC GEN	Indicates level of 100–kc output of 100–kc and 250–kc generator.
7 250 KC GEN	Indicates level of 250–kc output of 100–kc and 250–kc generator.
8 75/100 KC	Indicates combined level of 75–kc and 100–kc input signals to the mixer half of the divider in the 100–kc and 250–kc generator.
9 5 KC DIV	Indicates level of 5–kc output of 25–kc to 1–kc divider.

Frequency Standard—*CONTINUED*

Control or indicator	Function	
	Position	*Function*
	10 1 KC DIV	Indicates level of 1-kc output of 25-kc to 1-kc divider.
	11 1.5 KC GEN	Indicates level of 1.5-kc output from 4.5-kc generator.
	12 4.5 KC GEN	Indicates level of 4.5-kc output from 4.5-kc generator.

*Not an operator's adjustment.

3-3. Tsb Modulator
(fig. 1-4)

Control or indicator	Function
UPPER SIDEBAND selector switch	Controls the application of either the LINE 1 or LINE 2 audio input to the upper-sideband channel of the twin-sideband generator. When the switch is in the OFF position, a test signal connected to the TEST AUDIO INPUT jack is applied by the switch to the twin-sideband generator.
LOWER SIDEBAND selector switch	Controls the application of either the LINE 1 or LINE 2 audio input to the lower-sideband channel of the twin-sideband generator. When the switch is in the OFF position, a test signal connected to the TEST AUDIO INPUT jack is applied by the switch to the twin-sideband generator.
TEST AUDIO INPUT jacks	Provide connection for audio test signal to tsb modulator.
LINE 1 METER jacks	Provide connection for reading test signals directly on LINE 1 VU meter.
LINE 1 audio LEVEL control	Adjusts the level of the LINE 1 audio input. Clockwise rotation increases the level.
LINE 1 VU meter	Measures the level of LINE 1 audio input of automatic load control compression.
LINE 1 METER switch	Connects any one of three different circuits to LINE 1 VU meter. Switch positions are as follows:
	Position — *Function*
	0 — Provides normal level indication on meter.
	+6 — Reduces meter sensitivity so that signal level is 6 db higher than meter indication.
	ALC — Provides meter indication of approximate automatic load control (alc) compression in db.
LINE 2 audio LEVEL control	Adjusts the level of the LINE 2 audio input. Clockwise rotation increases the level.
LINE 2 VU meter	Measures the level of LINE 2 audio input on alc compression.
LINE 2 METER switch	Connects any one of three different circuits to LINE 2 VU meter. Switch positions are as follows:

Tsb Modulator—*CONTINUED*

Control or indicator	Function
	Position — *Function* 0 — Provides normal level indication on meter. +6 — Reduces meter sensitivity so that signal level is 6 db higher than meter indication. ALC — Provides meter indication of approximate ALC compression in db.
LINE 2 METER jacks	Provide connection for reading test signals directly on LINE 2 VU meter.
MONITOR AUDIO OUTPUT jacks	Provide connection to audio output of low-frequency monitor in exciter-monitor compartment.
DB CARRIER ATTENUATION variable attenuators.	Set the level of carrier signal that is reinserted in the output of the twin-sideband generator.

3–4. Exciter-Monitor
(fig. 1–5)

Control or indicator	Function
REMOTE-LOCAL switch	Selects either remote or local control of channel selection.
CHANNEL selector switch	Selects the preset channel on which operation is desired. The numerals engraved around the switch designate the 10 autotune channels available. The frequency corresponding to any one of these channels may be readily changed to any frequency within the range of 1.7 to 30 mc.
0.5 KC LOCK switch	Locks the operating frequency at 0.5–kc points. If the operating frequency falls on a 0.5–kc point, set the 0.5 KC LOCK switch to ON. If the operating frequency falls between 0.5 kc, the 0.5 KC LOCK switch must be set to OFF.
Test meter and METER SWITCH	Meter monitors any one of six circuits which may be selected by the METER SWITCH. Switch positions and monitoring functions are as follows: *Position* — *Function* 1. MONITOR SIGNAL LEVEL — Indicates the level of the signal selected by the MONITOR INPUT selector switch. 2. MO CONTROL CURRENT — Indicates cathode current in the control tube of the stabilized master oscillator (smo) error detector. 3. ϕ DETECTOR INPUT — Indicates signal level at the phase detector input of smo error detector. 4. ϕ DETECTOR REFERENCE. — Indicates level of the phase detector reference signal in the smo error detector.

Exciter-Monitor—*CONTINUED*

Control or indicator	Function
	5. LOW FREQ INJECTION. — Indicates level of output of master oscillator buffer in smo rf chassis.
	6. HIGH FREQ INJECTION — Indicates level of output of multiplier V1506 in stabilized master oscillator rf chassis.
MONITOR LEVEL	Controls the level of the signal applied to the monitor circuits. Clockwise rotation increases the signal level.
MONITOR INPUT selector switch	With the METER SWITCH in position 1, the MONITOR INPUT selector switch applies signals to the test meter and to the MONITOR AUDIO OUTPUT jacks in the tsb modulator. Switch positions and corresponding monitor inputs are as follows:
	Position — *Function*
	EXCITER INPUT — 300–kc signal from tsb modulator.
	EXCITER OUTPUT — 1.7–mc to 32.3–mc output of modulator-oscillator.
	PA SAMPLING — 1.7–mc to 32.3–mc amplified signal from power amplifier.
	EXTERNAL — Signal from external source.
	TEST — 300–kc test signal from frequency standard.
EXTERNAL PICKUP jack	Provides connection for test signal input to monitor circuits.
FREQ-MC control	Selects any 0.1–mc tuning step and changes reading of the mc digits of frequency-indicating dial. The tuning may be done manually when the locking key in the center of the control is turned counterclockwise. When the key is turned clockwise, the control is locked and under the control of the servomechanism. When using the FREQ-MC control to set up an operating frequency, make sure that the mechanical detent is engaged.
FREQ-KC control	Tunes the modulator-oscillator to any frequency over the 100–kc range selected by the FREQ-MC control, and changes reading of last three digits on frequency-indicating dial. The tuning may be done manually when the locking keys in the center of the FREQ-MC and FREQ-KC controls are turned counterclockwise. When the key is turned fully clockwise, the control is locked and is under the control of the servomechanism.

Note: Unlock the FREQ-MC control before manually operating the FREQ-KC control. See that the FREQ-MC mechanical detent follower is seated in a detent notch before relocking the FREQ-MC control. The smo will not stabilize if the detent is not seated.

BAND switch	Controls function of the exciter-monitor, tsb modulator, and power amplifier for operation of a transmitter on the five bands within the frequency range of 1.7 mc and 32.3 mc. When the locking key is turned counterclockwise, the BAND switch may be rotated manually. When the key is turned fully clockwise, the switch is locked and is under the control of the servomechanism. The switch positions and the corresponding frequency ranges are as follows:

Exciter-Monitor—*CONTINUED*

Control or indicator	Function
	Position — *Function* BAND 1 — 1.7 mc to 2.3 mc BAND 2 — 2.3 mc to 4.3 mc BAND 3 — 4.3 mc to 8.3 mc BAND 4 — 8.3 mc to 16.3 mc BAND 5 — 16.3 mc to 32.3 mc *Note:* After changing bands, see that the FREQ-MC control mechanical detent follower is seated in a detent notch.
MANUAL TUNE pushbutton	Releases mechanical tuning detents for manual tuning operations.

3–5. Power Supply Control (fig. 1–6)

Control or indicator	Function
FILAMENT ON-OFF momentary pushbutton switches.	Control power to the filament circuit, bias power supply, cabinet blower, and servomechanism.
FILAMENT indicator lamp (green)	Glows when the filament power relay is energized.
LINE indicator lamp (amber)	Glows when 115 vac is applied to the modulator-oscillator (blower filter assembly LINE SWITCH in the ON position).
STABILIZED indicator lamp (blue)	Glows when smo is phase locked. (No rf output is available until the smo is phase locked.)
PLATE indicator lamp (red)	Glows when the plate power relay is energized.
PLATE ON-OFF momentary pushbutton switches	Control power to the plate relay in the power supply.

3–6. Automatic Line Voltage Control Panel (fig. 1–7)

Control or indicator	Function
AUTOMATIC-MANUAL switch	Selects automatic or manual mode of line voltage control panel.
LINE ADJUST INCREASE control	Provides manual line voltage adjustment.
AUTOMATIC ADJUSTMENTS:	
VOLTAGE	Provides adjustment of the line voltage output when the AUTOMATIC-MANUAL switch is at AUTOMATIC.
SENSITIVITY	Sets sensitivity to line voltage variations (normally set at maximum).
LINE VOLTAGE meter	Indicates adjusted line voltage.

3–7. Power Supply (fig. 1–8)

Control or indicator	Function
Test meter and meter switch	Test meter indicates the output voltage of any one of eight circuits which may be selected by the meter switch. Switch positions and monitoring functions are as follows:

Power Supply—*CONTINUED*

Control or indicator	Function	
	Position	*Function*
	+28V MOTOR	Measures the 28–volt dc supply to the servomotor.
	+28V RELAY	Measures the 28–volt dc supply to the 28–volt relays.
	+300V EXCITER	Measures the 300–volt dc supply to the exciter-monitor and modulator.
	+300V FREQ. STD.	Measures the 300–volt dc supply to the frequency standard.
	+150V FREQ. STD.	Measures the 150–volt dc supply to the frequency standard.
	+125V EXCITER	Measures the 125–volt dc supply to the exciter-monitor and tsb modulator.
	+210V EXCITER	Measures the 210–volt dc supply to the exciter-monitor and tsb modulator.
	−105V BIAS	Measures the negative 105–volt dc bias supply.
FREQ. STD. PLATE fuse	Protects frequency standard dc supply circuits.	
MAIN PLATE fuse	Protects all dc circuits of the tsb modulator and exciter-monitor.	
BIAS SUPPLY fuse	Protects the negative 105–volt dc bias supply circuit.	
AUTOTUNE & RELAYS FUSE	Protects the 28–volt motor and relay supply primary circuits.	
RELAY POWER fuse	Protects all relays, except K803 in the exciter-monitor.	
RECTIFIER FIL fuse	Protects the filament circuits in the thyratron rectifiers of the tsb modulator and exciter-monitor supply.	
REGULATOR FIL fuse	Protects filaments of the +210–volt and +125–volt regulator tubes.	
FREQ. STD. FIL fuse	Protects the filament transformer in the exciter-monitor junction box.	
EXCITER FIL fuse	Protects filaments of all exciter-monitor tubes.	
MODULATOR FIL fuse	Protects the filament transformer in the main junction box.	

Section II. OPERATION

3–8. Types of Operation

The modulator-oscillator makes twin-sideband single-sideband, or low-level amplitude modulation operation possible. Other methods of operation are possible when additional equipment (para 1–15) is used.

3–9. Preliminary Starting Procedures

The stabilized master oscillator, which is a part of the frequency standard, requires a 24–hour warmup to insure maximum stability; therefore, the modulator-oscillator is normally left in the on condition unless it is to be turned off for an extended period of time. It is

assumed that the equipment has been adjusted and checked by higher category repairmen during the initial adjustment of the modulator-oscillator (para 2–10). Perform the procedures in *a* through *e* below to prepare the modulator-oscillator for operation.

a. Operate the blower filter assembly LINE SWITCH (fig. 1–1) to ON.

b. Set the automatic line voltage control panel AUTOMATIC-MANUAL switch (fig. 1–7) to AUTOMATIC. The LINE VOLTAGE meter should indicate 115 volts ac.

c. See that the blower filter assembly amber indicating light, located near the LINE SWITCH, is on.

d. Set the exciter-monitor REMOTE-LOCAL switch to LOCAL (fig. 1–5).

e. Tighten the winged locking keys on the FREQ-MC, BAND, and FREQ-KC switches.

3–10. General Starting Procedure

Caution: **Before operating the equipment, see that the winged locking keys on the FREQ-MC, BAND, and FREQ-KC switches on the exciter-monitor (fig. 1–5) are tight.**

a. Press the power supply control FILAMENT ON button (fig. 1–6). The green FILAMENT indicator lamp will glow. See that the cabinet blower is operating.

b. Operate the exciter-monitor CHANNEL switch to the channel that has been preset to the desired frequency.

c. Press the power supply control PLATE ON button (fig. 1–6). The red PLATE indicator lamp will glow. After a few seconds, the blue STABILIZED indicator lamp should glow. The rf output signal is now available at the output of the modulator-oscillator.

d. See the no blown-fuse indicators are glowing.

3–11. Starting Procedure for Tsb or Ssb Operation
(fig. 1–4)

Perform the preliminary starting and general starting procedures (para 3–9 and 3–10) before performing the procedures in *a* through *d* below.

Note: The DB CARRIER ATTENUATION controls (*a* below) on the tsb modulator determine the level of carrier signal that is reinserted in the output of the twin-sideband generator. The associated receiving system will determine the amount of carrier attenuation required.

a. Set the tsb modulator DB CARRIER ATTENUATION controls for the desired amount of reinserted carrier attenuation as determined by the characteristics of the associated receiving system. The attenuation is the sum of the readings of the two DB CARRIER ATTENUATION controls.

b. Set LINE 1 LEVEL and LINE 2 LEVEL controls to 0.

c. Adjust the audiofrequency input levels of both LINE 1 LEVEL and LINE 2 LEVEL controls (when both are used) for peak readings of 0 on their respective VU meters.

d. Operate the UPPER SIDEBAND and LOWER SIDEBAND selector switches to place the LINE 1 and LINE 2 audio inputs on the desired sideband channels.

3–12. Starting Procedure for Low-Level Amplitude Modulation
(fig. 1–4)

Complete the preliminary starting and general starting procedures (para 3–9 and 3–10) before performing the procedures in *a* through *d* below.

a. Set the DB CARRIER ATTENUATION controls on the tsb modulator to 0.

b. Set LINE 1 LEVEL and LINE 2 LEVEL controls to 0.

c. Adjust the audiofrequency input level of LINE 1 LEVEL or LINE 2 LEVEL (depending upon which line the audio is applied to) for a peak reading of 0 on the corresponding VU meter.

d. Place both UPPER SIDEBAND and LOWER SIDEBAND selector switches to the same line (the one to which audio is applied).

3–13. Tuning Procedure
(fig. 1–5)

The servodriven mechanical tuning system provides for automatic tuning of any 1 of 10 preset frequency channels from 1.7 to 32.3 mc. Each channel may be setup on any frequency within the operating range of the transmitter. Each position of the CHANNEL selector switch will correspond to a preset frequency; when this switch is positioned, the exciter-

monitor will be tuned automatically to the corresponding frequency. When required, the system may be tuned manually (*b* below) by changing the tuning of any 1 of the 10 preset channels. During tuning procedures, the power supply control blue STABILIZED indicator lamp (fig. 1–6) will be extinguished automatically until a few seconds after the procedure is completed. Rf output is not available while this indicator is extinguished.

a. Presetting Channel Frequencies. Perform the procedures in paragraph 2–10*c* (1) through (10) to set up a preset channel frequency.

b. Manual Tuning. Perform the following procedures to tune the exciter-monitor (fig. 1–5) manually.

(1) Turn the FREQ-MC, FREQ-KC, and BAND control locking keys fully clockwise.
(2) Turn the REMOTE-LOCAL control to LOCAL.
(3) Rotate the CHANNEL selector switch to a channel, the frequency of which may be changed.
(4) Rotate the FREQ-MC, FREQ-KC, and BAND control locking keys counterclockwise.
(5) Set the BAND switch on the desired band.
(6) Press the MANUAL TUNE pushbutton, and rotate the FREQ-MC and FREQ-KC controls to obtain the desired operating frequency within the selected band on the frequency-indicating dial. Release the MANUAL TUNE push button, and check to make sure the FREQ-MC detent follower is in a detent notch.
(7) For continued manual tuning, repeat the procedures in (5) and (6) above to select other frequencies.
(8) Repeat the procedure in (1) above before changing the position of the CHANNEL selector switch.

3–14. Stopping Procedure
(fig. 1–6)

a. For standby operation with the filaments lighted, press the PLATE OFF button of the power supply control.

b. To turn the modulator-oscillator off when a transmitting schedule has been completed, press the FILAMENT OFF button.

Note: After pressing the FILAMENT OFF button, filament and plate voltages of the frequency standard are still on. Ordinarily, the frequency standard should be on at all times to insure most stable operation.

c. If transmission is to be discontinued indefinitely, operate the blower filter assembly LINE SWITCH (fig. 1–1) to OFF. After the LINE SWITCH is set to OFF and the frequency standard has cooled, approximately 24 hours warmup time is required to obtain most stable operation.

CHAPTER 4

OPERATOR'S MAINTENANCE

4–1. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Modulator-Oscillator Group OA–2180/FRT–51 are listed below together with a reference to the paragraphs covering the specific maintenance function. These duties do not require special tools or test equipment.

a. Daily preventive maintenance checks and services (para 4–4).

b. Weekly preventive maintenance checks and services (para 4–5).

c. Cleaning (para 4–6).

d. Replacement of defective indicator lamps.

e. Replacement of defective fuses.

4–2. Materials Required for Operator's Maintenance

a. Cleaning Compound (FSN 7930–395–9542).

b. Bleached cheesecloth, lint-free.

c. Fine bristle brush.

4–3. Operator's Preventive Maintenance

Operator's preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 4–4 through 4–6 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (para 4–4 and 4–5) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat-serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and the normal conditions; the *References* column lists the illustrations, paragraphs, or manuals that contain detailed maintenance procedures. If a defect cannot be remedied by the operator, higher category maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38–750.

c. Preventive Maintenance Checks and Services Periods. Paragraph 4–4 contains preventive maintenance checks and services which are required daily. Instructions for weekly preventive maintenance checks and services are provided in paragraph 4–5. Preventive maintenance checks and services for any period should be performed in *addition* to these preventive maintenance checks and services which are required at more frequent intervals.

4–4. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Cables and connectors	Remove dust and dirt from all cables, with a clean cloth.	Para 4–6.
2	Cleanliness	Check to see that exposed metal surfaces are free of dust, dirt, and moisture.	Para 4–6.
3	Controls and indicators	During normal operation, observe that controls and indicators move freely and without binding. Observe that knobs are secure on their respective shafts.	Fig. 1–1, and 1–3 through 1–8.
4	Operation	During operation, be alert for any unusual occurrences.	Para 3–9 through 3–13.
5	Fuses and lamps	Insure that no blown-fuse indicators are energized. Replace defective fuses and lamps.	Fig. 1–1.

4–5. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Cables	Check to see that cables are free of cuts, cracks, or other signs of deterioration. Repair cable insulation by covering damaged area with friction tape.	None.
2	Connectors	Check to see that connectors are free of corrosion, damaged inserts and pins, and that insulating material is not damaged.	None.

4–6. Cleaning

Inspect the exterior of the modulator-oscillator. The exterior surfaces should be clean, and free of dust, dirt, grease, and fungus.

Caution: **Do not disturb any front-panel controls while cleaning the exterior of the equipment. Do not press on the meter faces (glass) when cleaning; the meter may become damaged.**

a. Remove dust and loose dirt with a clean soft cloth. Dampen the cloth with water and use a mild detergent for more effective cleaning.

Warning: **Prolonged breathing of cleaning compound (FSN 7930–395–9542 is dangerous; make certain that adequate ventilation is provided. Cleaning compound is flammable; *do not* use near a flame. Avoid contact with the skin; wash off any that spills on your hands.**

b. Remove grease, fungus, and ground-in dirt; use a cloth dampened (not wet) with cleaning compound.

c. Remove dust or dirt from plugs and jacks with a soft brush.

CHAPTER 5

ORGANIZATIONAL MAINTENANCE

Section I. GENERAL

5-1. Scope of Organizational Maintenance

The duties assigned to organizational maintenance repairmen are listed below together with a reference to the paragraphs covering the specific maintenance function.

a. Monthly preventive maintenance checks and services (para 5-4 and 5-5).

b. Quarterly preventive maintenance checks and services (para 5-6 and 5-7).

c. Visual inspection (para 5-10).

d. Troubleshooting (para 5-12 and 5-13).

e. Air filter cleaning (para 5-8).

f. Touchup painting (para 5-9).

5-2. Materials Required for Organizational Maintenance

No special tools or test equipment is required. The materials required for organizational maintenance are listed below.

a. Cleaning Compound (FSN 7930-395-9542).

b. Sandpaper No. 0000.

c. Bleached cheesecloth, lint-free

d. Paint, proper type

e. Paintbrush

5-3. Organizational Preventive Maintenance

a. Organizational preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all categories concerned with the equipment and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of Modulator-Oscillator Group OA-2180/FRT-1 at the organizational category are made at quarterly intervals unless otherwise directed by the commanding officer. The preventive maintenance checks and services should be scheduled concurrently with the periodic services scheduled at more frequent intervals.

b. Maintenance forms and records to be used and maintained on this equipment are specified in TM 38-750.

5-4. Monthly Maintenance

Perform the maintenance functions indicated in the monthly maintenance checks and services chart (para 5-5) once each month. A month is defined as approximately 30 calendar days of 8-hour-per-day operation. If the equipment is operated 16 hours a day, the monthly maintenance should be performed at 15-day intervals. Adjustment of the maintenance interval should be made to compensate for any unusual operating conditions. Equipment maintained in a standby (ready for immediate operation) condition must have monthly preventive maintenance checks and services. Equipment in limited storage (requires service before operation) does not require monthly maintenance.

5–5. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Preservation	*a.* Check exterior surfaces for evidence of fungus, rust, and corrosion.	*a.* None.
		b. Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion.	*b.* Para 5–9.
2	Cables	Tighten all cable connections	None.
3	Interlocks	Check for bent or broken interlocks	None.
4	Pluckout items	Inspect seating of pluckout items	Fig. 5–1 through 5–5.
5	Relays	Look for burned or damaged relay contacts	None.

5–6. Quarterly Maintenance

Quarterly preventive maintenance checks and services on Modulator-Oscillator Group OA–2180/FRT–51 are required. Periodic weekly and monthly services constitute a part of the quarterly preventive maintenance checks and services and must be performed concurrently. All deficiencies or shortcomings must be recorded in accordance with the requirements of TM 38–750. Perform all the checks and services listed in the quarterly preventive maintenance checks and services chart (para 5–7) in the sequence listed.

5–7. Quarterly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Completeness	See that the equipment is complete	Appx B.
2	Installation	See that the equipment is properly installed	Para 2–1 and 2–5.
3	Publications	See that all publications are complete, serviceable, and current.	DA Pam 310–4 and appx A.
4	Modification work orders.	Check DA Pam 310–4 to determine if new applicable MWO's have been published. ALL URGENT MWO's must be applied immediately. All ROUTINE MWO's must be scheduled.	DA Pam 310–4.
5	Gaskets	Check gaskets for moisture, oil saturation, and brittle, broken, cracked, loose, pinched, mismatched, or missing sections.	None.
6	Air filter	Clean	Para 5–8.
7	Interlocks	Check for shorted, loose, dirty, bent, or broken interlocks.	None.
8	Fuses	See that all operating fuses are of the correct value. Check spare fuses for proper value and quantity.	Appx B.
9	Cabinet	See that all bolts, nuts, and washers are correctly positioned and properly tightened. Check for cracked, bent, or broken brackets.	None.
10	Connections	Check to be sure that plugs and sockets are clean, intact, and not loose fitting.	None.
11	Blower filter assembly (lowest panel on modulator-oscillator).	Set LINE SWITCH to ON. Switch remains ON. No blown-fuse indicators energized. Amber LINE indicator on power supply control energized.	Fig. 1–1 and 1–6.

Quarterly Preventive Maintenance—*CONTINUED*

Sequence No.	Item	Procedure	References
12	Automatic line voltage control panel AUTOMATIC-MANUAL switch.	Set to AUTOMATIC. Manual LINE ADJUST INCREASE knob may or may not turn, but will reach a position of rest if the line voltage remains constant.	Fig. 1–7.
13	Automatic line voltage control panel LINE VOLTAGE meter.	Meter should indicate 115 volts	Fig. 1–7.
14	Power supply meter switch.	Set to +300V FREQ. STD. Meter indicates within green area.	Fig. 1–8.
15	Power supply meter switch.	Set to +150V FREQ. STD. Meter indicates within green area.	Fig. 1–8.
16	Frequency standard METER switch.	Set to 1. Meter indicates between 2 and 4	Fig. 1–3.
17	Frequency standard METER switch.	Set to 2. Meter indicates between 2 and 6	Fig. 1–3.
18	Frequency standard METER switch.	Set to 3. Meter indicates from 4.5 to 6.5	Fig. 1–3.
19	Frequency standard METER switch.	Set to 4. Meter indicates from 5 to 7	Fig. 1–3.
20	Frequency standard METER switch.	Set to 5. Meter indicates 4 to 7	Fig. 1–3.
21	Frequency standard METER switch.	Set to 6. Meter indicates 5 ±0.1	Fig. 1–3.
22	Frequency standard METER switch.	Set to 7. Meter indicates 5 ±0.1	Fig. 1–3.
23	Frequency standard METER switch.	Set to 8. Meter indicates from 4 to 6	Fig. 1–3.
24	Frequency standard METER switch.	Set to 9. Meter indicates from 4 to 7	Fig. 1–3.
25	Frequency standard METER switch.	Set to 10. Meter indicates from 5 to 8	Fig. 1–3.
26	Frequency standard METER switch.	Set to 11. Meter indicates from 2 to 4	Fig. 1–3.
27	Frequency standard METER switch.	Set to 12. Meter indicates from 3 to 5	Fig. 1–3.
28	Exciter-monitor autotune locking keys on FREQ-MC, FREQ-KC, and BAND controls.	Turn clockwise until tight. Dial knobs locked in position.	Fig. 1–5.
29	Power supply control FILAMENT ON button.	Press button. Green FILAMENT indicator glows and blower runs.	Fig. 1–6.
30	Power supply meter switch.	Set to 8. Meter reads within green area	Fig. 1–8.
31	Power supply control PLATE ON switch.	Press button. Red PLATE indicator light glows.	Fig. 1–6.
32	Power supply meter switch.	Set to +300V EXCITER. Meter reads within green area.	Fig. 1–8.
33	Power supply meter switch.	Set to +125V EXCITER. Meter reads within green area.	Fig. 1–8.
34	Power supply meter switch.	Set to +210V EXCITER. Meter reads within green area.	Fig. 1–8.
35	Exciter-monitor METER SWITCH.	Set to 2. Depress MANUAL TUNE button. Meter reads 5 ±0.2.	Fig. 1–5.

Quarterly Preventive Maintenance—*CONTINUED*

Sequence No.	Item	Procedure	References
36	Exciter-monitor METER SWITCH.	Set to 3. Meter reads not less than 2 for each BAND setting (1 through 5).	Fig. 1–5.
37	Exciter-monitor METER SWITCH.	Set to 4. Meter reads not less than 3 on BAND 1 and BAND 2, not less than 2 on BAND 3 and BAND 4, and not less than 1 on BAND 5.	Fig. 1–5.
38	Exciter-monitor METER SWITCH.	Set to 5. Meter reads not less than 5 _____	Fig. 1–5.
39	Exciter-monitor METER SWITCH.	Set to 6. Meter reads not less than 4 on BAND 3, BAND 4, and BAND 5.	Fig. 1–5.
40	Tsb modulator LINE 1 and LINE 2 METER switches.	Set LINE 1 METER switch to +6 db _____ Set LINE 2 METER switch to +6 db _____ Adjust the audiofrequency input levels of both LINE 1 and LINE 2 for peak readings of 0 on their respective VU meters. Both VU meters should indicate 0 _____	Fig. 1–4.
41	Exciter-monitor _____	Set both DB CARRIER ATTENUATION controls on Tsb modulator fully counterclockwise. On exciter-monitor, set METER SWITCH to 1 and MONITOR INPUT selector switch to TEST. Rotate MONITOR LEVEL control clockwise to produce midscale deflection on the test meter. MONITOR LEVEL control setting should be 7 or less.	Fig. 1–5 and 1–4.
42	Exciter-monitor _____	Set MONITOR INPUT selector switch to EXCITER INPUT. Rotate MONITOR LEVEL control clockwise to obtain a midscale reading on the test meter. Control position should be between 2.5 and 3.5 __	Fig. 1–5.
43	Tsb modulator _____	Set DB CARRIER ATTENUATION controls to 0. Set UPPER SIDEBAND and LOWER SIDEBAND selector switches to OFF. Meter on exciter-monitor indicates between 2.5 and 3.5.	Fig. 1–4.
44	Exciter-monitor _____	Set MONITOR LEVEL control to obtain midscale meter reading. Control setting should not be higher than 4 ____	Fig. 1–5.
45	Exciter-monitor _____	Set BAND switch to BAND 2 _____ Set MONITOR LEVEL control to obtain midscale meter reading. Control setting should not be higher than 4 ____	Fig. 1–5.
46	Exciter-monitor _____	Set BAND switch to BAND 3 _____ Set MONITOR LEVEL control to obtain midscale meter reading. Control setting should not be higher than 8 ____	Fig. 1–5.
47	Exciter-monitor _____	Set BAND switch to BAND 4 _____ Set MONITOR LEVEL control to obtain midscale meter reading. Control setting should not be higher than 8 ____	Fig. 1–5.
48	Exciter-monitor _____	Set BAND switch to BAND 5 _____ Set MONITOR LEVEL control to obtain midscale meter reading. Control setting should not be higher than 8 ____	Fig. 1–5.

5–8. Air Filter Cleaning

Inspect and clean the air filter.

a. Use blowers to blow out dust.

Warning: **Compressed air is dangerous and can cause serious bodily harm. It can cause mechanical damage to the equipment.** ***Do not*** **use compressed air to dry parts where cleaning compound has been used.**

b. Pour cleaning compound over the filter. Place a large basin under the filter to catch the compound. After the dirt particles settle, the clear liquid can be reused.

c. Use a light water spray to flush out the loosened dirt.

d. After the filter is dry, spray light oil *very sparingly* on the side of the filter that faces the flow of air. To prevent oil from being spread throughout the equipment by air suction, avoid using excess oil.

5–9. Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to prevent further corrosion. Refer to the applicable cleaning and refinishing practices specified in TB SIG 364 and TM 9–213.

Section II. TROUBLESHOOTING

5–10. Visual Inspection

a. When failure is encountered and the cause is not immediately apparent, check the items listed in *b* below before starting a systematic check of the equipment. Do not, however, disassemble the equipment for a complete inspection without some knowledge of the operational symptoms. If possible, obtain information from the operator of the equipment regarding performance at the time the trouble occurred.

b. Complete failure of the equipment often may be caused by one or more of the following faults:

(1) Loss of primary power.
(2) Open main switch.
(3) Defective interchassis connections.

5–11. Tube Replacement by Substitution

a. When trouble occurs, check all cabling, connections, control settings, and the general condition of the equipment before attempting removal of electron tubes. Try to isolate the trouble to a particular stage or plug-in assembly.

b. Replace tubes, one at a time, with new tubes. Discard a tube only if its defect is obvious or if replacement by a new tube clears the trouble.

5–12. Troubleshooting Procedures

Troubleshooting this equipment is based upon the operational check contained in the quarterly preventive maintenance checks and services chart. To troubleshoot the equipment, perform all functions starting with item number 11 in the quarterly preventive maintenance checks and services chart (para 5–7) and proceed through the items until an abnormal condition or result is observed. When an abnormal condition or result is observed, check to see that related fuses and indicator lamps are operative. If the abnormal condition has not been caused by a defective fuse or indicator lamp, turn to the corresponding item number in the troubleshooting chart (para 5–13). Perform the checks and corrective measures indicated in the troubleshooting chart. If the corrective measures indicated do not result in correction of the trouble, higher category maintenance is required.

Warning: **Dangerous voltage exists in the modulator-oscillator. Certain troubleshooting procedures require that the equipment be energized with the cabinet doors or drawers open, thereby exposing the high-voltage points. Whenever an interlock, shorting switch, or other protective device is blocked or otherwise disabled, extreme danger exists to maintenance personnel. Do not disable the protective devices unless it is absolutely necessary. Remove all disabling equipment immediately after the maintenance procedure is complete.**

Do not leave the equipment location while protective devices are disabled. Always ground circuits before touching them. Dangerous potentials exist in this equipment. Do not service alone. Do not depend on interlocks and grounding switches for protection.

5–13. Troubleshooting Chart

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
11	LINE switch on blower filter assembly does not remain at ON. Amber LINE indicator on power supply control is not energized.	Facility power failure Poor connections	Check facility power supply. Check connections in junction box.
12	Automatic line voltage control panel LINE ADJUST increase knob does not come to rest.	Poor connections	Check connections between automatic line voltage control panel and junction box.
13	LINE VOLTAGE meter does not indicate 115 volts.	Improper settings of VOLTAGE and SENSITIVITY controls.	Adjust AUTOMATIC ADJUSTMENTS VOLTAGE and SENSITIVITY controls.
14	Power supply meter indication outside green area while meter switch is set to +300 V FREQ. STD.	Defective tube V2301	Replace V2301 (fig. 5–2).
15	Meter indication outside green area while meter switch is set to +150V FREQ. STD.	Defective tubes V2301 and V2305.	Replace V2301 and V2305 (fig. 5–2).
16	Improper frequency standard meter deflection while METER switch is in position 1.	Defective tubes V605 and V606.	Replace V605 and V606 (fig. 5–3).
17	Improper meter deflection while METER switch is in position 2.	Defective tubes V601 through V604.	Replace V601 through V604 (fig. 5–3).
18	Improper meter deflection while METER switch is in position 3.	Defective tubes V901 and V902.	Replace V901 and V902 (fig. 5–3).
19	Improper meter deflection while METER switch is in position 4.	Defective tubes V901 and V902.	Replace V901 and V902 (fig. 5–3).
20	Improper meter deflection while METER switch is in position 5.	Defective tubes V901 and V902.	Replace V901 and V902 (fig. 5–3).
21	Improper meter deflection while METER switch is in position 6.	Defective tube V503	Replace V503 (fig. 5–3).
22	Improper meter deflection while METER switch is in position 7.	Defective tube V504	Replace V504 (fig. 5–3).
23	Improper meter deflection while METER switch is in position 8.	Defective tube V501	Replace V501 (fig. 5–3).
24	Improper meter deflection while METER switch is in position 9.	Defective tube V1301	Replace V1301 (fig. 5–3).
25	Improper meter deflection while METER switch is in position 10.	Defective tube V1302	Replace V1302 (fig. 5–3).
26	Improper meter deflection while METER switch is in position 11.	Defective tubes V701, V702, and V703.	Replace V701, V702 and V703 (fig. 5–3).
27	Improper meter deflection while METER switch is in position 12.	Defective tube V703	Replace V703 (fig. 5–3).
28	Exciter-monitor FREQ-MC, FREQ-KC, and BAND dial knobs do not lock in position.		Higher category repair required.

Troubleshooting Chart—*CONTINUED*

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
29	Green FILAMENT indicator on power supply control does not light.	Blown fuse	Check blown-fuse indicators on power supply.
	Blower fails to operate	Interconnecting cables	Check interconnecting cables.
30	Power supply meter indication outside green area while meter switch is in position 8.	Defective tube V2304	Replace V2304 (fig. 5–2).
31	Power supply control red PLATE indicator fails to light.	Interconnecting cables	Check interconnecting cables.
32	Power supply meter indication outside green area while meter switch is in the +300V EXCITER position.	Defective tubes V2302, V2303, V2306, and V2309.	Replace V2302, V2303, V2306, and V2309 (fig. 5–2).
33	Meter indication outside green area while meter switch is in the +125V EXCITER position.	Misadjusted potentiometer R2332.	Adjust R2332 (fig. 5–2).
34	Meter indication outside green area while meter switch is in the +210V EXCITER position.	Misadjusted potentiometer R2335. Defective tube V2306.	Adjust R2335. Replace V2306 (fig. 5–2).
35	Improper excitor-monitor meter deflection while METER SWITCH is in position 2.	Misadjusted potentiometer R1742.	Adjust R1742 with TP1706 grounded (fig. 5–1).
36	Improper meter deflection while METER SWITCH is in position 3.	Defective tubes V1501, V1502, V1504, V1505, V1701, and V1702.	Replace V1501, V1502, V1504, V1505 (fig. 5–4) and V1701 and V1702 (fig. 5–1). If only one or two bands are low, check V1502 first.
37	Improper meter deflection while METER SWITCH is in position 4.	Same as item 36 above	Same as item 36 above.
38	Improper meter deflection while METER SWITCH is in position 5.	Defective tube V1503	Replace V1503 (fig. 5–4).
39	Improper meter deflection while METER SWITCH is in position 6.	Defective tubes V1506 and V1507.	Replace V1506 and V1507 (fig. 5–4).
40	Improper tsb modulator deflection of either or both VU meters.		Higher category repair required.
41	Improper exciter-monitor MONITOR LEVEL control setting.	Defective tubes V1401 through V1406.	Replace V1401 through V1406 (fig. 5–1).
42	Improper MONITOR LEVEL control setting.	Adjustment required	Perform the following: Pull out the tsb modulator drawer (fig. 5–5). Set alc switch S401 to OFF. Set agc switch S4501 to OFF. Set the DB CARRIER ATTENUATION control to 0. Adjust LEVEL control R4505 to produce midscale reading on the meter when the MONI-

Troubleshooting Chart—*CONTINUED*

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
			TOR LEVEL control is set to 3. Set S4501 to NORM and ALC switch S401 to ON.
43	Improper tsb modulator meter deflection at prescribed control settings.		Higher category repair required.
44	Exciter-monitor MONITOR-LEVEL control setting excessively high.	Defective tubes V1801 through V1804.	Replace V1801 through V1804 (fig. 5–4).
45	MONITOR LEVEL control setting excessively high while BAND switch is set to BAND 2.	Defective tubes V1901 through V1904.	Replace V1901 through V1904 (fig. 5–4).
46	MONITOR LEVEL control setting excessively high while BAND switch is set to BAND 3.	Defective tubes V2001 through V2003.	Replace V2001 through V2003 (fig. 5–4).
47	MONITOR LEVEL control setting excessively high while BAND switch is set to BAND 4.	Defective tubes V2101 through V2103.	Replace V2101 through V2103 (fig. 5–4).
48	MONITOR LEVEL control setting excessively high while BAND switch is set to BAND 5.	Defective tubes V2201 through V2203.	Replace V2201 through V2203 (fig. 5–4).

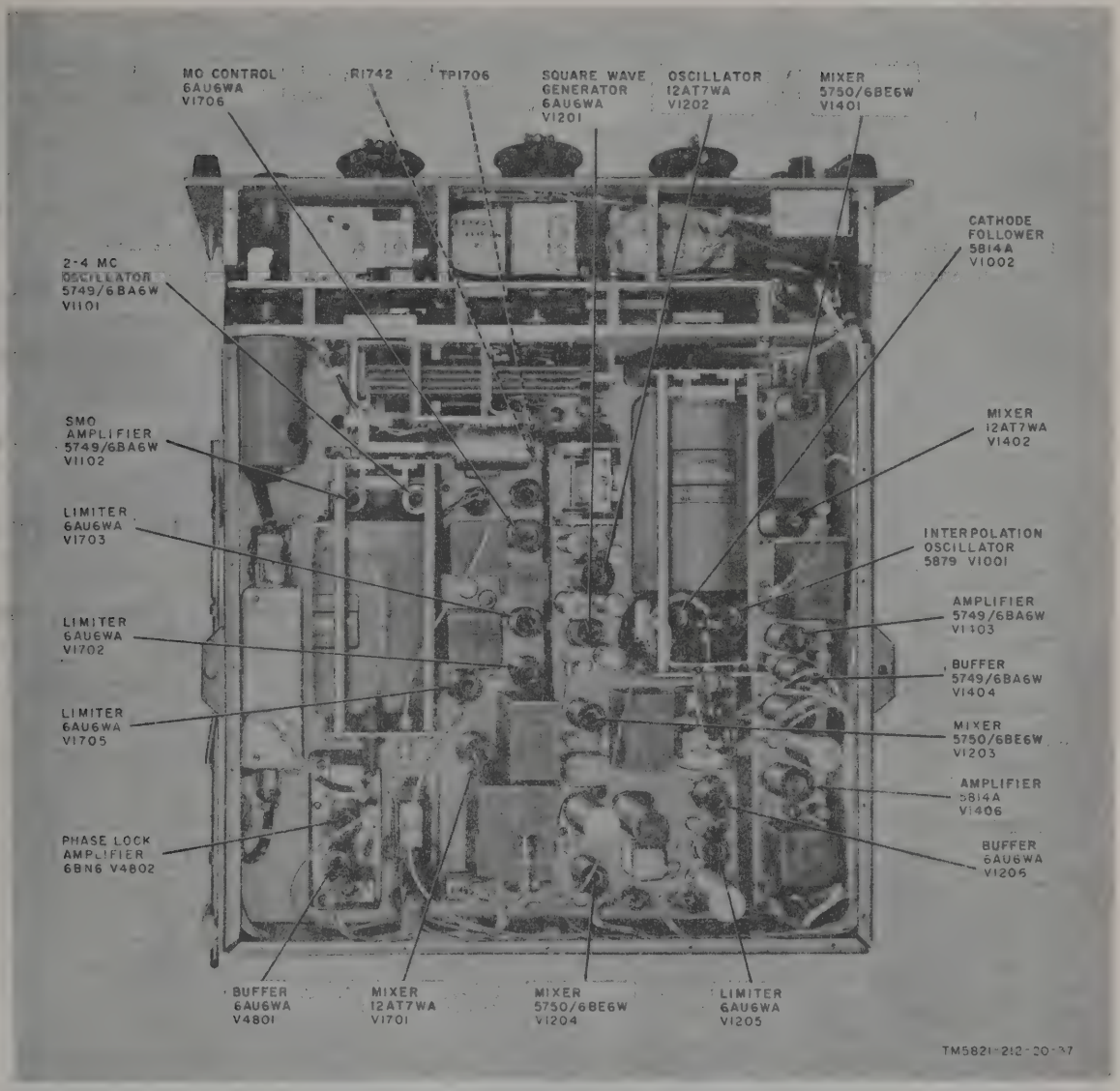


Figure 5-1. Exciter-monitor chassis, bottom view.

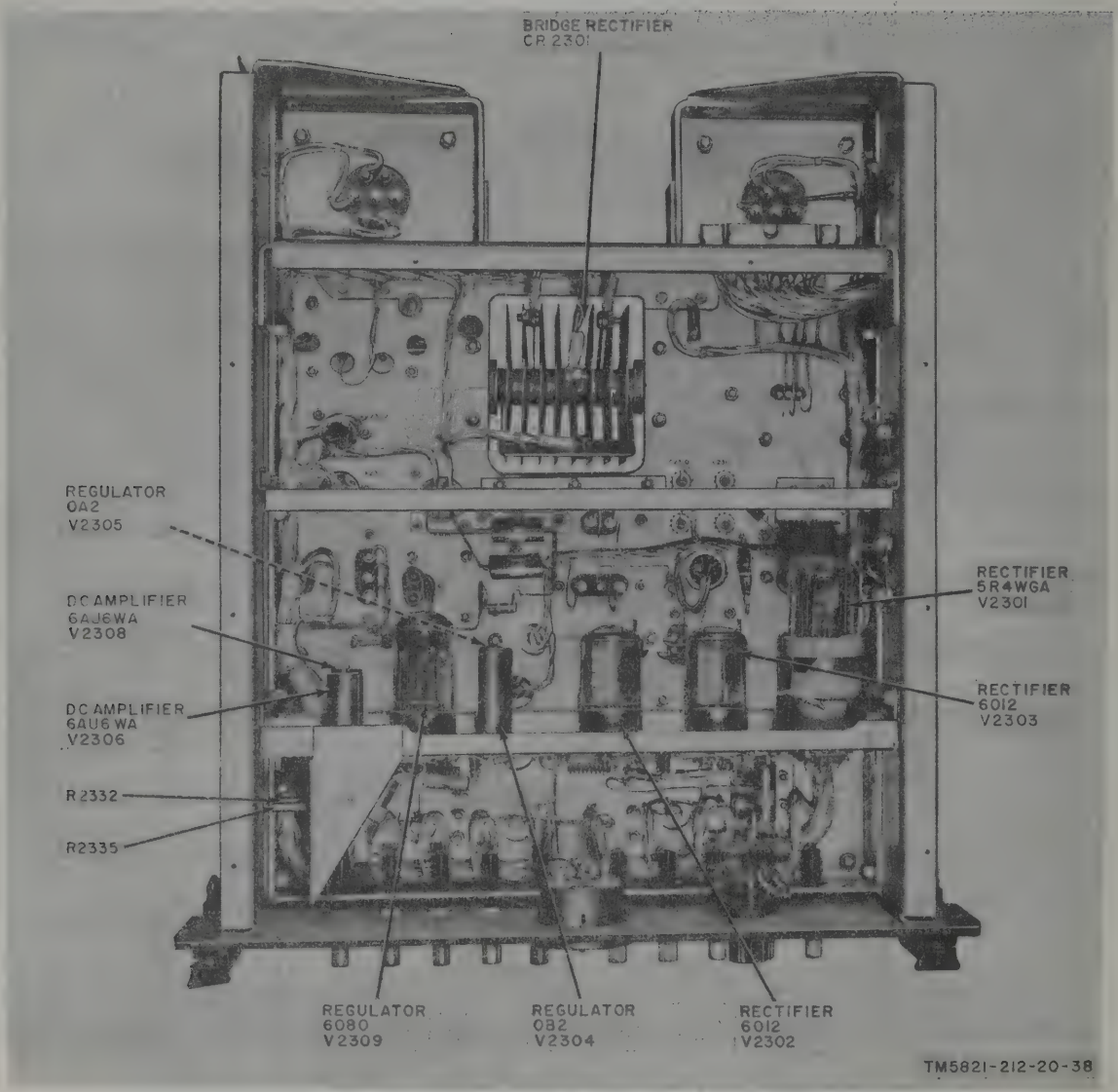


Figure 5-2. Power supply, top view.

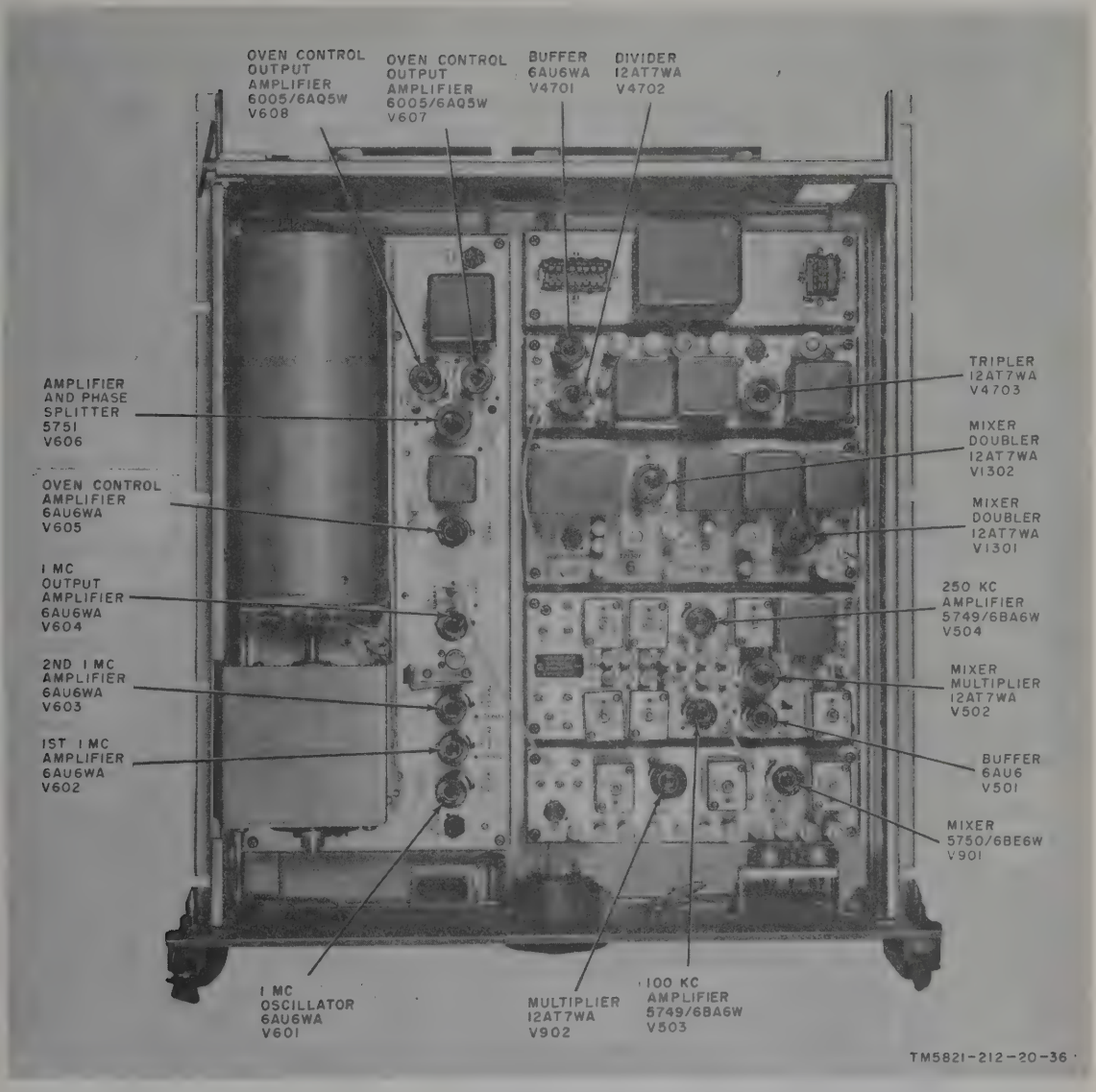

OVEN CONTROL OUTPUT AMPLIFIER 6005/6AQ5W V608
OVEN CONTROL OUTPUT AMPLIFIER 6005/6AQ5W V607
BUFFER 6AU6WA V4701
DIVIDER 12AT7WA V4702
TRIPLER 12AT7WA V4703
MIXER DOUBLER 12AT7WA V1302
MIXER DOUBLER 12AT7WA V1301
250 KC AMPLIFIER 5749/6BA6W V504
MIXER MULTIPLIER 12AT7WA V502
BUFFER 6AU6 V501
MIXER 5750/6BE6W V901
100 KC AMPLIFIER 5749/6BA6W V503
MULTIPLIER 12AT7WA V902
1 MC OSCILLATOR 6AU6WA V601
AMPLIFIER AND PHASE SPLITTER 5751 V606
OVEN CONTROL AMPLIFIER 6AU6WA V605
1 MC OUTPUT AMPLIFIER 6AU6WA V604
2ND 1 MC AMPLIFIER 6AU6WA V603
1ST 1 MC AMPLIFIER 6AU6WA V602
TM5821-212-20-36

Figure 5-3. Frequency standard chassis, tube location.

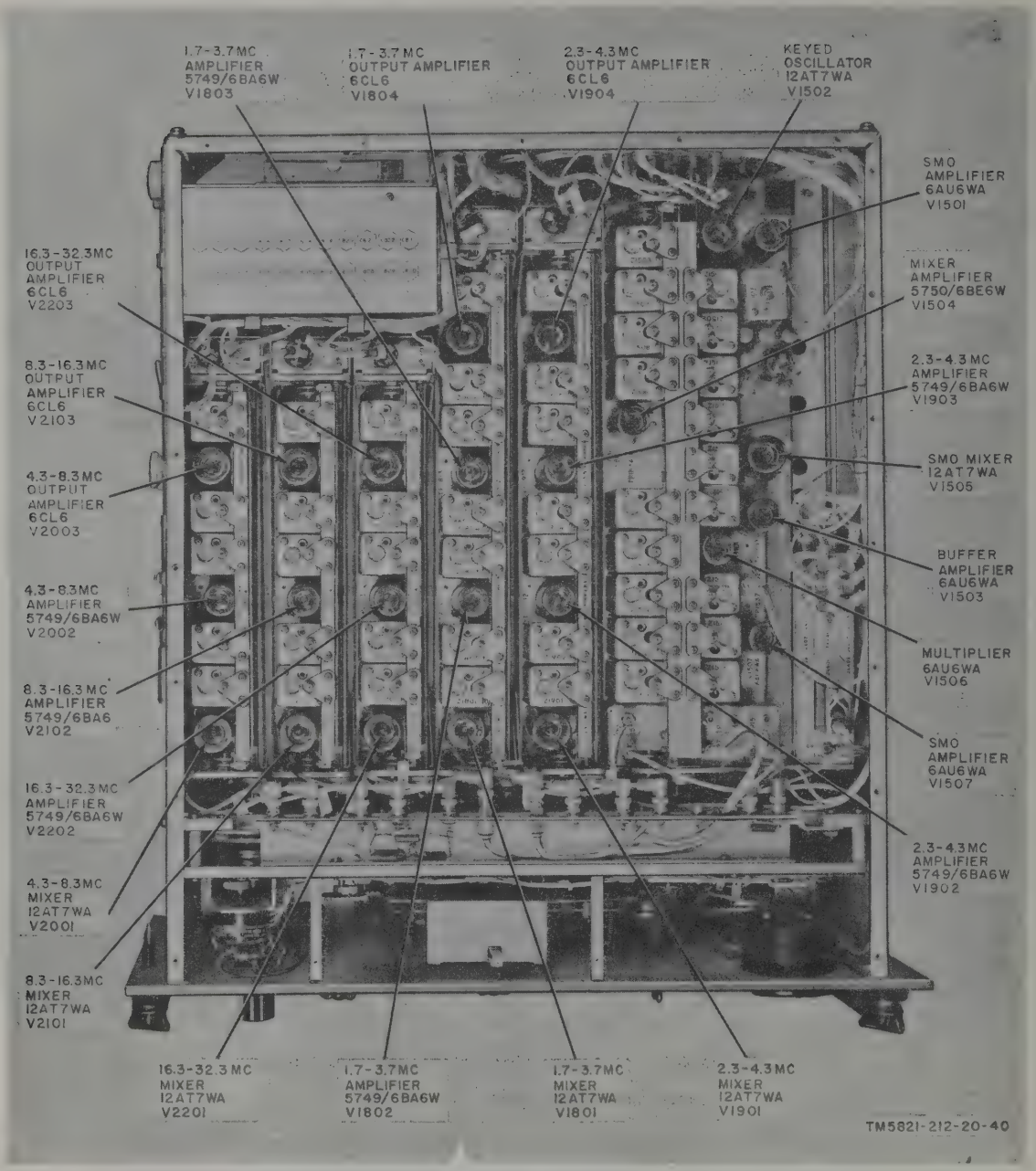

1.7-3.7MC AMPLIFIER 5749/6BA6W V1803
1.7-3.7MC OUTPUT AMPLIFIER 6CL6 V1804
2.3-4.3MC OUTPUT AMPLIFIER 6CL6 V1904
KEYED OSCILLATOR 12AT7WA V1502
SMO AMPLIFIER 6AU6WA V1501
MIXER AMPLIFIER 5750/6BE6W V1504
2.3-4.3MC AMPLIFIER 5749/6BA6W V1903
SMO MIXER 12AT7WA V1505
BUFFER AMPLIFIER 6AU6WA V1503
MULTIPLIER 6AU6WA V1506
SMO AMPLIFIER 6AU6WA V1507
2.3-4.3MC AMPLIFIER 5749/6BA6W V1902
16.3-32.3MC OUTPUT AMPLIFIER 6CL6 V2203
8.3-16.3MC OUTPUT AMPLIFIER 6CL6 V2103
4.3-8.3MC OUTPUT AMPLIFIER 6CL6 V2003
4.3-8.3MC AMPLIFIER 5749/6BA6W V2002
8.3-16.3MC AMPLIFIER 5749/6BA6 V2102
16.3-32.3MC AMPLIFIER 5749/6BA6W V2202
4.3-8.3MC MIXER 12AT7WA V2001
8.3-16.3MC MIXER 12AT7WA V2101
16.3-32.3MC MIXER 12AT7WA V2201
1.7-3.7MC AMPLIFIER 5749/6BA6W V1802
1.7-3.7MC MIXER 12AT7WA V1801
2.3-4.3MC MIXER 12AT7WA V1901
TM5821-212-20-40

Figure 5–4. Exciter-monitor chassis, top view.

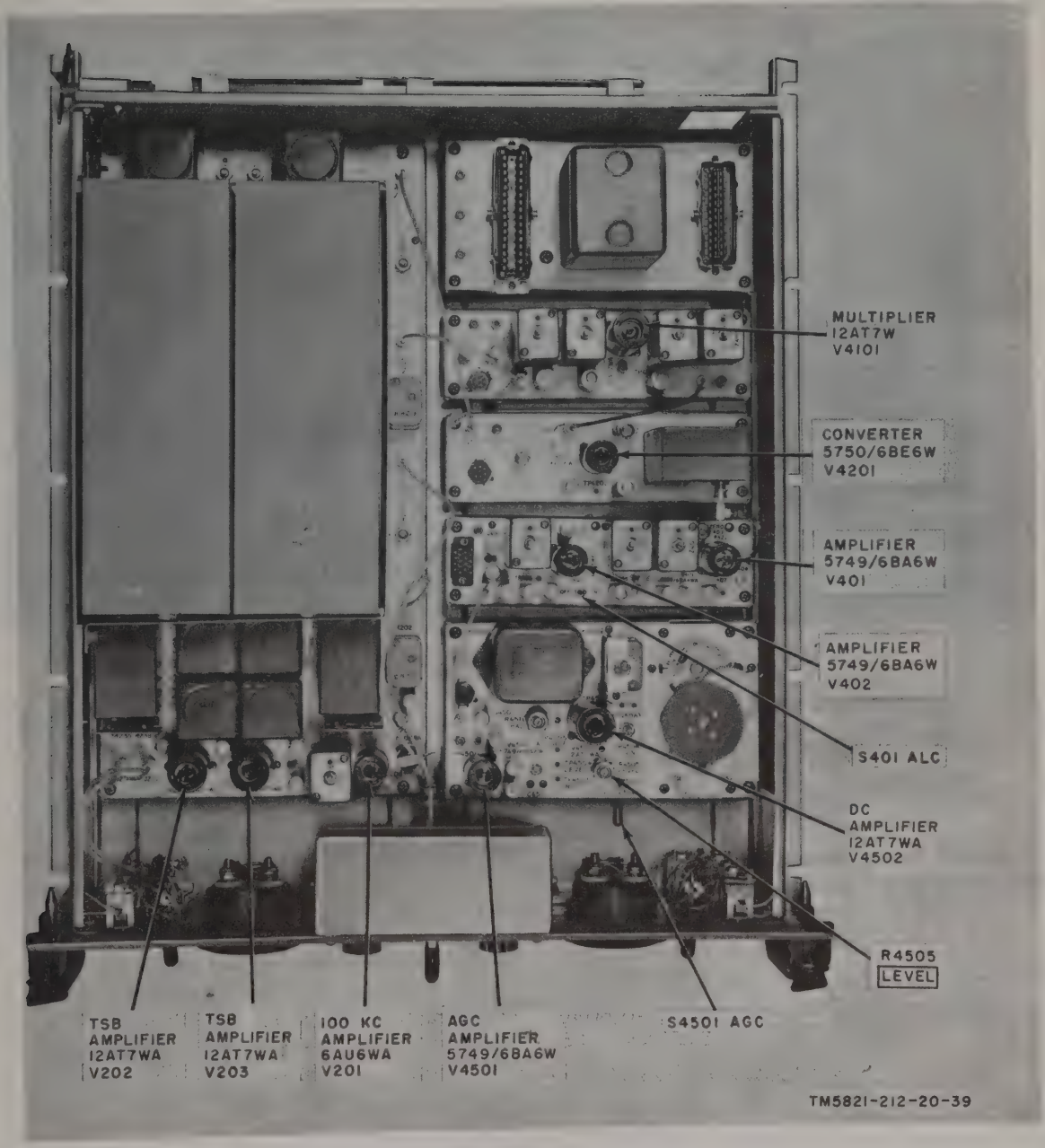


Figure 5–5. Tsb modulator, top view.

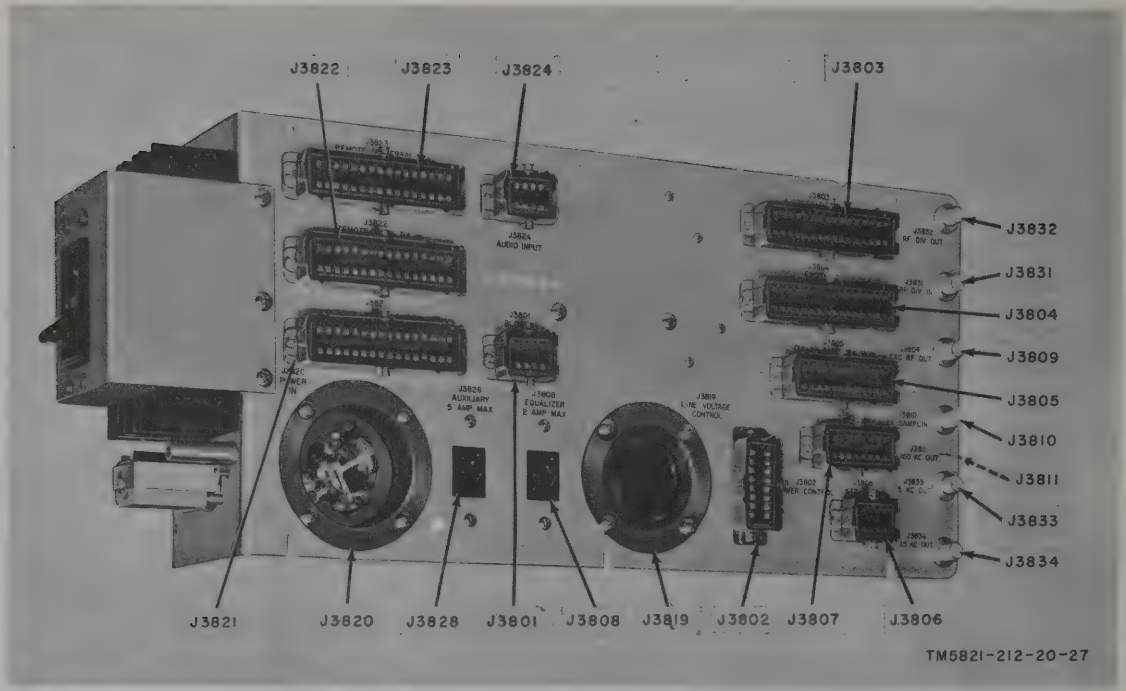


Figure 5–6. Main junction box, jack location.

CHAPTER 6

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

6–1. Disassembly

Disassemble the modulator-oscillator as follows:

a. Disconnect all cabling to the equipment.

b. Disconnect all intracabinet cables.

c. If the base is bolted to the floor, remove the bolts.

6–2. Repackaging for Shipment or Limited Storage

The modulator-oscillator may be shipped from the using organization without special packaging. If repackaging is done, the exact procedures depend on the materials available and the conditions under which the equipment is to be shipped. The information concerning the original packaging (para 2–3) can be helpful.

Section II. DEMOLITION TO PREVENT ENEMY USE

6–3. Authority for Demolition

Demolition of the modulator-oscillator to prevent enemy use will be accomplished only upon order of the commanding officer. The destruction procedures outlined in paragraph 6–4 will be used to prevent further use of the equipment.

6–4. Methods of Destruction

Use any of the following methods to destroy the equipment:

a. Smash. Smash the controls, tubes, tube sockets, crystals, crystal ovens, relays, switches, capacitors, and servomechanisms.

b. Cut. Cut all cords, cabling, and internal wiring.

c. Burn. Burn the equipment and technical manuals.

Warning: **Be extremely careful with explosives and incendiary devices. Use those items only when the need is urgent.**

d. Explode. If necessary, use explosives.

e. Dispose. Bury or scatter the destroyed parts in slit trenches, foxholes, or throw them into streams.

APPENDIX A

REFERENCES

The following is a list of applicable references available to the operator and organizational maintenance personnel of Modulator-Oscillator Group OA–2180/FRT–51:

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SB 11–573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
SB 38–100	Preservation, Packaging and Packing Materials, Supplies, and Equipment Used by the Army.
TB SIG 364	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 9–213	Painting Instructions for Field Use.
TM 11–5821–212–10	Operators Manual: Radio Transmitting Set AN/FRT–51.
TM 11–5821–212–20	Organizational Maintenance Manual: Radio Transmitting Set AN/FRT–51.
TM 38–750	Army Equipment Record Procedures.

APPENDIX B

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

B–1. General

This appendix lists items supplied for initial operation and for running spares. The list includes tools, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

B–2. Columns

Columns are as follows:

a. Federal Stock Number. This column lists the 11–digit Federal stock number.

b. Designation by model. Not used.

c. Description. Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

d. Unit of Issue. The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

e. Expendability. Nonexpendable items are indicated by NX. Expendable items are not annotated.

f. Quantity Authorized. Under "Items Comprising an Operable Equipment", the column lists the quantity of items supplied for initial operation of the equipment. Under "Running Spare Items", the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

g. Illustration. The "Item No." column lists the reference designations that appear on the part in the equipment.

Section II. FUNCTIONAL PARTS LIST

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
5820-679-3430		MODULATOR-OSCILLATOR GROUP OA-2180/FRT-51		NX			
ORD thru AGC		TECHNICAL MANUAL TM 11-5820-215-12			2		
		ITEMS COMPRISING AN OPERABLE EQUIPMENT					
5820-056-6851		CABINET, ELECTRICAL EQUIPMENT CY-3747/FRT-51: steel w/gray color finish; 24 in d x 22 in w x 75 in h; Collins part/dwg 544-1176-004 (Mounted in equip)		NX	1		
5820-056-6852		CONTROL-INDICATOR C-4445/FRT-51: oper power 115vac, 60 cps, 1 ph; contains momentary push button switches that control the application of filament and plate power; Collins part/dwg 543-8700-005 (Mounted in equip)		NX	1		
5820-056-6854		CONVERTER-AMPLIFIER-MODULATOR CV-1411/FRT-51: provides 300 kc independent sideband modulator output and automatic load control Collins part/dwg 544-1193-005 (Mounted in equip)		NX	1		
5820-056-6822		CONVERTER-MONITOR CV-1410/FRT-51: converts 300 kc to 1.7 to 30 mc and provides amplification necessary to produce 0.1w output Collins part/dwg 543-8785-005 (Mounted in equip)		NX	1		
5820-056-6823		COOLER, AIR, ELECTRONIC EQUIPMENT HD-581/FRT-51: 115vac, 50/60 cps, 1 ph; Collins part/dwg 543-8639-005 (Mounted in equip)		NX	1		
5820-056-6824		INTERCONNECTING BOX J-2123/FRT-51: provides a connecting and branching point for electrical circuits (Mounted in equip)		NX	1		
5820-056-6825		MAINTENANCE KIT, ELECTRONIC EQUIPMENT MK-686/FRT-51: provides necessary tools and accessories for proper maintenance and repair; Collins part/dwg 544-2180-00 (Mounted in equip)		NX	1		
5820-056-6821		OSCILLATOR-DIVIDER, FREQUENCY O-1044/FRT-51: provides the basic frequencies; Collins part/dwg 543-8614-005 (Mounted in equip)		NX	1		
5820-056-6853		POWER SUPPLY PP-3564/FRT-51: supplies power for various major components; Collins part/dwg 543-8676-006 (Mounted in equip)					
5950-892-8195		TRANSFORMER ASSEMBLY TF-425/FRT-51: provides automatic and manual control of line voltage of 115vac and 230 vac; Collins part/dwg 543-8693-005 (Mounted in equip)		NX	1		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
		OA-2180/FRT-51 (continued)					
5950-892-8214		TRANSFORMER ASSEMBLY TF-451/FRT-51: provides 600 ohm balance input; Collins part/dwg 546-3220-004 (Mounted in equip)		NX	1		
		GROUP 1 CABINET, ELECTRICAL EQUIPMENT CY-3747/FRT-51					
5995-652-5641		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 50 ohm; 10 ft 2 in lg excl term; Collins part/dwg 544-1195-002			1		W3807
5995-652-5639		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 10 ft 10-7/16 in lg excl term; Collins part/dwg 544-1196-002			1		W3808
5995-649-8358		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 9 ft 6 in lg excl term; Collins part/dwg 544-1202-003			1		W3809
5995-655-2166		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 10 ft 8 in lg excl term; Collins part/dwg 544-1197-002			1		W3810
5995-649-8359		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 10 ft lg excl term; Collins part/dwg 544-1198-002			1		W3811
5995-655-2158		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 4 cond; 5 ft 2 in lg excl term; Collins part/dwg 544-1203-003			1		W3813
5995-655-2160		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 7 cond; 9 ft 2-1/2 in lg excl term; Collins part/dwg 5441201-003			1		W3806
5995-655-2156		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 11 cond; 6 ft 5 in lg excl term; Collins part/dwg 544-1200-003			1		W3802
5995-655-2153		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 13 cond; 7 ft 9 in lg excl term; Collins part/dwg 544-1206-004			1		W3805
5995-655-2155		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 23 cond; 3 ft 8 in lg excl term; Collins part/dwg 544-1203-004			1		W3803
5995-655-2154		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 25 cond; 7 ft 7 in lg excl term; Collins part/dwg 544-1205-004			1		W3804

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
		OA-2180/FRT-51 (continued)					
		GROUP 2 INTERCONNECTING BOX J-2123/FRT-51					
5995-810-9460		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 8 cond; Collins part/dwg 546-3215-003			1		W3814
		GROUP 3 MAINTENANCE KIT, ELECTRONIC EQUIPMENT MK-686/FRT-51					
5935-655-1243		ADAPTER, CONNECTOR: 1 female cont and 2 male cont; IPC 47425			2		E2612 E2613
5935-201-8420		ADAPTER, CONNECTOR: 1 male cont, 1 female cont; MIL type UG-635/U Item Nos. E2609,E2610,E2611			3		See esc column
5120-585-8513		ALLIGNMENT TOOL, ELECTRONIC EQUIPMENT: wrench type; 2 working ends; 5-7/8 in lg o/a; Collins part/dwg 505-2119-001			1		H2602
5306-655-9491		BOLT, EYE: 1/2-13 NC class 2 fit; 1-1/2 in lg; Collins part/dwg 544-2183-002			4		H2635
5995-655-2660		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 50 ohm; 3 ft lg o/a; Collins part/dwg 544-2195-002			2		W2605 W2606
5995-655-2165		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 50 ohm; 20 ft lg o/a; Collins part/dwg 544-2200-002			1		W2613
5995-655-2164		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 50 ohm; 3 ft lg o/a; Collins part/dwg 544-2201-002			1		W2614
5995-655-2662		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 50 ohm; 5 in lg o/a; Collins part/dwg 544-2189-002			1		W2612
5995-655-2162		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 75 ohm; 3 ft lg o/a; Collins part/dwg 544-2196-002			2		W2607 W2608
5995-655-2163		CABLE ASSEMBLY, RADIO FREQUENCY: coax; 75 ohm; 1 ft lg o/a; Collins part/dwg 544-2198-002			1		W2609
5995-655-2317		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 4 cond 37 in lg o/a; Collins part/dwg 544-2199-002			1		W2610
5995-655-2161		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 7 cond; 36-1/4 in lg o/a; Collins part/dwg 544-2211-003			2		W2603 W2604

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
		OA-2180/FRT-51 (continued)					
5995-655-2157		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 9 cond; 36-1/4 in lg o/a; Collins part/dwg 544-2209-003			2		W2601 W2602
5995-655-2159		CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 18 cond; 36-3/8 in lg o/a; Collins part/dwg 544-2207-003			2		W2611 W2612
5820-652-8913		CASE, ELECTRICAL EQUIPMENT, MAINTENANCE KIT: steel; 7-5/8 in x 8-1/8 in x 17 in; Stratton & Terstegge Co part #617		NX	1		H2601
5935-201-3484		CONNECTOR, PLUG, ELECTRICAL: 4 male cont; Hubbell part 7426			1		P2651
5935-543-8640		CONNECTOR, PLUG, ELECTRICAL: 8 male cont; Amphenol part 26-4501-8P			1		P815
5995-655-2152		CORD ASSEMBLY, ELECTRICAL: 2 tinsel cond; Audio Dev part PJ-11			1		W2615 W2616
5995-283-8457		CORD ASSEMBLY, ELECTRICAL: 2 tinsel cond; 29-5/8 in lg; Audio Dev part PJ-12			2		W2617 W2618
5995-577-8130		CORD ASSEMBLY, ELECTRICAL 2 tinsel cond; 41-5/8 in lg; Audio Dev part PJ-13			2		W2619 W2620
5120-585-8514		EXTRACTOR, ELECTRON TUBE: scissors type; Insuline Corp part 1001			1		
5805-679-9904		HOLDER, BRISTOWRENCH: bronze; 1/2 in x 1-5/16 in x 1-11/16 in; Collins part/dwg 507-6327-00			1		H2604
6625-542-1338		LEAD, TEST: 1 cond, 18 AWG; 20-27/32 in lg; Collins part/dwg 544-2216-004			1		Z2601
6625-542-1335		LEAD, TEST: 1 cond, 18 AWG; 20.296 in lg; Collins part/dwg 544-2218-004			1		Z2603
6625-542-1334		LEAD, TEST: 1 cond, 18 AWG; 20-27/32 in lg; Collins part/dwg 544-2215-004			1		Z2604
6625-542-1336		LEAD, TEST: 2 cond, 20-27/32 in lg; Collins part/dwg 544-2217-004			1		Z2602
5310-017-3687		NUT, PLAIN, HEXAGON: steel; 5/8-11 NC class 2 fit; Collins part/dwg 313-0157-00			4		H2637
5820-629-9981		PROBE, WAVEGUIDE: Collins part/dwg 542-2153-002			1		E2608

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
		OA-2180/FRT-51 (continued)					
5120-050-8924		SCREWDRIVER, OFFSET: flat tip 90 deg angle; 3 in lg; Collins part/dwg 549-5432-002			1		
5120-646-7607		WRENCH, SOCKET: 3/16 in od x 4-1/2 in lg; 1 working end w/oval socket; Collins part/dwg 505-6860-002			1		H2614
5120-224-2504		WRENCH, SOCKET HEAD SCREW: 5/64 in w across flats; L type handle 1-7/8 in lg; Collins part/dwg 024-0059-00			1		H2603
5120-249-9670		WRENCH, SOCKET HEAD SCREW: spline type; 4 flute; L type handle; 1.749 in lg; Collins part/dwg 024-9730-00			1		H2606
5120-293-0195		WRENCH, SOCKET HEAD SCREW: splined type; 6 flutes; L type handle; 1-9/16 in lg; Collins part/dwg 024-2900-00			1		H2605
5120-223-6995		WRENCH, SOCKET HEAD SCREW: splined type; 6 flutes; L type handle; 1-7/8 in lg; Collins part/dwg 024-0019-00			1		
5120-224-2482		WRENCH, SOCKET HEAD SCREW: splined type; 6 flutes; L type handle; 1.666 in lg; Collins part/dwg 024-9710-00			1		H2608
5120-585-8512		WRENCH, SOCKET HEAD SCREW: splined type; 6 flutes; T type handle; 3.187 in lg; Collins part/dwg 544-2190-002			1		H2613
5120-585-8510		WRENCH, SOCKET HEAD SCREW: splined type; 6 flutes; screwdriver type handle; 1-1/8 in lg blade; Collin part/dwg 024-0202-00			1		H2610
5120-585-8509		WRENCH, SPANNER: tubular type; Collins part/dwg 544-2213-002			1		H2609
		RUNNING SPARE ITEMS					
5977-284-9988		BRUSH SET, ELECTRICAL CONTACT: for autotone motor B801A; HAmilton Beach part AUC-61			2		
5340-285-7729		CLAMP, LOOP: nylon; Burndy part HP-3N			2		
5340-598-0383		CLAMP, LOOP: nylon; Burndy part HP4N			2		
5340-285-7729		CLAMP LOOP: nylon; Burndy part HP-5N			2		
5340-598-6780		CLAMP LOOP: nylon; Burndy part HP-6N			2		
5340-598-0296		CLAMP LOOP: nylon; Burndy part HP-7N			2		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
		OA-2180/FRT-51 (continued)					
5960-284-6804		FUSE, CARTRIDGE: 3/4 amp; 250 vdc; time delay; MIL type F02B250V3-4AS			6		
5920-280-4465		FUSE, CARTRIDGE: 1 amp; 250vdc; time delay; MIL type F02B250V1AS			6		
5920-280-5020		FUSE, CARTRIDGE: 1-1/2 amp; 125vdc; time delay; MIL type F02B125V11-2AS			6		
5920-131-9821		FUSE, CARTRIDGE: 3 amp; 125 vdc; time delay; MIL type F02B125V3AS			6		
5935-201-7922		JACK, TIP: plastic; Sealectro part SKT-1			10		
6240-143-3060		LAMP, INCANDESCENT: 120v; 6w; Collins part/dwg 262-0041-00			2		
5340-543-3443		RING, RETAINING: copper; 0.138 in id x 0.155 od x 0.010 in thk; Collins part/dwg 340-0641-00			10		
5340-695-2558		RING, RETAINING: copper; 0.161 in id x 0.185 in od x 0.12 in thk; Collins part/dwg 340-0642-00			20		
5305-619-1326		SCREW, EXTERNALLY RELIEVED BODY: 8-32 NC 2A thd; Collins part/dwg 544-2237-002			12		
5305-616-6347		SCREW, MACHINE: brass; 6-32 NC 2A thd; Collins part/dwg 343-0333-00			10		
5305-616-8661		SCREW, MACHINE: SS; 8-32 NC 2A thd; Collins part/dwg 343-0196-00			20		
5305-616-6350		SCREW, MACHINE: 6-32 NC 2Athd; Collins part/dwg 343-0173-00			10		
5940-537-7289		TERMINAL, FEED-THRU, INSULATED: Sealectro part FT-M-2			10		
5940-615-5240		TERMINAL, FEED-THRU, INSULATED: 0.489 in lg x 0.218 in dia; Sealectro part RST-1			10		
5940-543-8704		TERMINAL, STUD: brass; 0.350 in lg x 0.172 in dia; Sealectro part ST-SM-1			10		

FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY AUTH	ILLUSTRATION	
						FIGURE NO.	ITEM NO.
		OA-2180/FRT-51 (continued)					
5340-598-0496		CLAMP LOOP: nylon; Burndy part HP-8N			2		
5340-336-8164		CLAMP LOOP: nylon; Burndy part HP-10N			2		
5950-617-3233		CORE, ADJUSTABLE TUNING: Collins part/dwg			6		
5960-188-3564		ELECTRON TUBE: MIL type 0A2			1		
5960-166-7648		ELECTRON TUBE: MIL type 0B2			1		
5960-262-1703		ELECTRON TUBE: MIL type 5R4WGA			1		
5960-188-0896		ELECTRON TUBE: MIL type 6BN6			1		
5610-230-5307		ELECTRON TUBE: MIL type 6CB6			1		
5960-615-0243		ELECTRON TUBE: MIL type 6CL6			2		
5960-262-0152		ELECTRON TUBE: MIL type 6AU6WA			6		
5960-262-0167		ELECTRON TUBE: MIL type 12AT7WA			6		
5960-264-2089		ELECTRON TUBE: MIL type 5749/6BA6W			5		
5960-264-3002		ELECTRON TUBE: MIL type 5750/6BE6W			2		
5960-193-5145		ELECTRON TUBE: MIL type 5751			1		
5960-827-8780		ELECTRON TUBE: MIL type 5814A			1		
5960-808-6490		ELECTRON TUBE: RCA type 5879			1		
5960-669-6861		ELECTRON TUBE: MIL type 6005/6AQ5W			1		
5960-296-2464		ELECTRON TUBE: MIL type 6012			1		
5960-543-1001		ELECTRON TUBE: MIL type 6080WA			1		
5920-284-9493		FUSE, CARTRIDGE: 1/8 amp; 250vdc; time delay; MIL type F02B250V1-8AS			6		
5920-280-9320		FUSE, CARTRIDGE: 1/2 amp; 250vdc; time delay; MIL type F02B250V1-2AS			6		

APPENDIX C

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C—1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature for Modulator-Oscillator Group OA–2180/FRT–51. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C—2. Explanation of Format for Maintenance Allocation Chart

a. Group Number. Group numbers correspond to the reference designation prefix assigned in accordance with ASA Y32.16, Electrical and Electronics Reference Designations. They indicate the relation of listed items to the next higher assembly.

b. Component Assembly Nomenclature. This column lists the item names of component units, assemblies, subassemblies, and modules on which maintenance is authorized.

c. Maintenance Function. This column indicates the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

Code	*Maintenance Category*
C	Operator/Crew
O	Organizational Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

d. Tools and Equipment. The numbers appearing in this column refer to specific tools and equipment which are identified by these numbers in section III.

e. Remarks. Self explanatory.

C—3. Explanation of Format for Tool and Test Equipment Requirements

The columns in the tool and test equipment requirements chart are as follows:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number.

e. Tool Number. Not used.

SECTION II. MAINTENANCE ALLOCATION CHART

MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
1	MODULATOR OSCILLATOR GROUP OA-2180/FRT-51	C												
1A	FREQUENCY STD	C										D	1,5-25	
1A1	1 MC XTAL OSC					#			. H				11,16 11,16	Refer to TM 11-5820-215-35
1A2	100 KC AND 300 KC GENERATOR					H			 O	 H			15,19 1,2 1,4-23	
1A3	250 KC AND 25 KC GENERATOR					H			 O	 H			9 1,2 1,4-23	
1A4	4.5 KC GENERATOR								O	F			1,2 1,3-12	
1A5	25 KC TO 1 KC DIVIDER								O				1,2	
1A6	POWER BOX								 F	F F			1,3-12 1,3-12 1,3-12	
1A7	FRONT PANEL								F	 F			1,3-12 1,3-12	
1B	TSB MODULATOR			O			#					D	1,5-25	Refer to TM 11-5821-215-35
1B1	TWIN SIDEBAND GENERATOR					H			 O	 H			7,10 1,2 1,4-23	

# Indicates that maintenance guidance will be found in documents referenced in remarks column.

MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	OA-2180/FRT-51 (continued)													
1B2	300 KC CONVERTER								O				1,2	
1B3	AUTOMATIC LOAD CONTROL AMPLIFIER									F			1,3-12	
					H								19,10	Refer to TM 11-5821-215-35
							#						10	
									O				1,2	
										H			1,4-23	
1B4	AUTOMATIC GAIN CONTROL UNIT								O				1,2	
										F			1,3-12	
1B5	100 KC to 400 KC MULTIPLIER					H							7,17	
									O				1,2	
										H			1,4-23	
1B6	MODULATOR FRONT PANEL								F				1,3-12	
										F			1,3-12	
1B7	MODULATOR JUNCTION BOX								O				1,2	
										F			1,3-12	
1C	EXCITER MONITOR	C											1	
				O									1,2	
												D	1,5-25	
1C1	MASTER OSCILLATOR					H							20,17	
									F				1,3-12	
										H			1,4-23	
1C2	INTERPOLATOR OSCILLATOR					H							17	
									H				1,4-23	
										H			1,4-23	

#Indicates that maintenance guidance will be found in documents referenced in remarks column.

MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	OA-2180/FRT-51 (continued)													
1C3	SMO ERROR DETECTOR						F						20	
									O				1,2	
										F			1,3-12	
1C4	PHASE LOCK INDICATOR					H								
									O				1,2	
										H			1,4-23	
1C5	MIXER AMPLIFIER BAND 1					H							18,15,16	Align only if new neutralization capacitor installed
									O				1,2	
										H			1,4-23	
1C6	MIXER AMPLIFIER BAND 2					H							18,15,16	Refer to Remarks for 1C5
									O				1,2	
										H			1,4-23	
1C7	MIXER AMPLIFIER BAND 3					H							18,15,16	Refer to Remarks for 1C5
									O				1,2	
										H			1,4-23	
1C8	MIXER AMPLIFIER BAND 4								O				1,2	No alignment needed
										F			1,3-12	
1C9	MIXER AMPLIFIER BAND 5								O				1,2	No alignment needed
										F			1,3-12	
1C10	SMO RF ASSEMBLY						H						1,4-23	
									H				1,4-23	
										H			1,4-23	
1C11	TUNING COILS AND CORES								F				1,3-12	
1C12	FRONT PANEL								O				1,2	
										F			1,3-12	

MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	OA-2180/FRT-51 (continued)													
1C13	MONITOR SUBCHASSIS								O	F			1,2 1,3-12	
1C14	BAND SWITCH SUBCHASSIS								O	F			1,2 1,3-12	
1C15	5 KC SPECTRUM DETENT SUBCHASSIS					H			O	F			1,2 1,3-12	
1C16	GAIN FREQUENCY POTENTIOMETER					F			F				7,23 1,3-12	
1C17	FREQ-MC POSITIONING HEAD								F	F			1,3-12 1,3-12	
1C18	FREQ-KC POSITIONING HEAD								F	F			1,3-12 1,3-12	
1C19	BAND SWITCH POSITIONING HEAD								F	F			1,3-12 1,3-12	
1C20	AUTOMATIC TUNING CONTROL HEAD								O	F				
1C21	MECHANICAL INTERPOLATION UNIT								F	D				
1C22	0.5 KC MICROSWITCH #5805					F			F				7 1,3-12	
1C23	FREQUENCY COUNTER DIAL ASSEMBLY					F			F	F			17 1,3-12 1,3-12	

MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
	OA-2180/FRT-51 (continued)													
1C24	AUTO TUNING DRIVE MOTOR								F				1,3-12	
										F			1,3-12	
												D		
1D	POWER SUPPLY CONTROL	C												
									O				1,2	
										F			1,3-12	
1E	TRANSFORMER PANEL								F				1,3-12	
										F			1,3-12	
1F	AUTOMATIC LINE VOLTAGE CONTROL	C												
									O				1,2	
										F			1,3-12	
1G	MODULATOR OSCILLATOR POWER SUPPLY	C												
									O				1,2	
										F			1,3-12	
1H	BLOWER FILTER ASSEMBLY	O											1,2	
				O									1,2	
									O				1,2	
										F			1,3-12	

TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
		OA-2180/FRT-51 (continued)		
1	C,O,F,H,D	ALIGNMENT TOOL	5120-585-8513	
2	O	TOOL KIT TK-105	5180-610-8177	
3	F	FREQUENCY METER USM-159	6625-892-5360	
4	F,H	TEST SET ELECTRON TUBE TV-7/U	6625-376-4937	
5	F,H,D	ANALYZER SPECTRUM TS-723/U	6625-151-7479	
6	F,H,D	MULTIMETER AN/URM-105	6625-581-2036	
7	F,H,D	MULTIMETER ME-26/U	6625-542-6407	
8	F,H,D	OSCILLOSCOPE OS-8F/U	6625-643-1740	
9	F,H,D	AMMETER ME-65/U	6625-752-8817	
10	F,H,D	VOLTMETER ME-30A/U	6625-669-0742	
11	F,H,D	TOOL KIT TK-100	5180-605-0079	
12	F,H,D	AUDIO OSCILLATOR TS-382F/U	6625-151-7479	
13	H,D	FREQUENCY METER AN/URM-80	6625-649-4286	
14	H,D	FREQUENCY METER AN/USM-207 (USE USM-26 UNTIL USM-207 BECOMES AVAILABLE)	6625-911-6368	
15	H,D	FREQUENCY METER AN/URM-79	6625-668-9749	
16	H,D	RADIO RECEIVER R-390/URR	5280-503-1242	
17	F,H,D	FREQUENCY METER AN/TSM-16	6625-542-1666	
18	F,H,D	ALIGNMENT TOOL Z2601		
19	F,H,D	ALIGNMENT TOOL Z2602		
20	F,H,D	SHORTING TOOL Z2603		
21	F,H,D	ALIGNMENT TOOL Z2604		

TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
		OA-2180/FRT-51 (continued)		
22	F,H,D	PINION CRANK H2609		
23	F,H,D	SYNCHRONIZING TOOL H2613		
24	D	RESISTANCE BRIDGE ZM-4/U	6625-648-8979	
25	D	TEST SET ELECTRON TUBE TV-7/U	6625-669-0263	

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By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
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- MDW (1)
- Armies (2)
- Corps (2)
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- Instl (2) except
  - Ft Hancock (4)
  - Ft Gordon (10)
  - Ft Huachuca (10)
  - WSMR (5)
  - Ft Carson (25)
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- USAIS (2)
- USAES (2)
- USATC Armor (2)
- USAECFB (2)
- USATC Inf (2)
- USASTC (2)
- Army Dep (2) except
  - LBAD (14)
  - SAAD (30)
  - TOAD (14)
  - LEAD (7)
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  - NAAD (5)
  - SVAD (5)
  - CHAD (3)
  - ATAD (10)
- Gen Dep (2)
- Sig Sec, Gen Dep (5)
- Sig Dep (12)
- WRAMC (1)
- Army Pic Cen (2)
- AMS (1)
- Sig FLDMS (2)
- USAERDAA (2)
- USAERDAW (13)
- USACRREL (2)
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  - 11–158
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  - 11–587
  - 11–592
  - 11–597

NG: None.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1966—254-430/1822